In January 2009, George W. Bush's second term as President of the United States will come to an end. Where is the world after eight years of his presidency?

- The Iraq War, justified by false accusations, has cost more than $500 billion in direct costs and may end with total costs of more than $3 trillion. It has taken the lives of more than 4,000 US soldiers, and a much larger number of Iraqis, estimated from between 150,000 and one million people.
- Preemptive strike doctrines threaten states with nuclear capabilities and ambitions, making nuclear war more likely. US missile defense programs in Eastern Europe provoke harsh reactions from the Russian government, reminiscent of the Cold War. The relationship with China is undermined by US missile defense programs and plans for dominance in space. Both China and the US have tested antisatellite weapons which could spur an arms race in space.
- The US threat against so-called "rogue states" has not prevented them from continuing their nuclear programs: North Korea exploded a nuclear device in 2006 and Iran remains unimpressed by the threat of intervention. Furthermore, the proposed nuclear deal between India and the United States would set a bad precedent for nuclear proliferation.
- The "War on Terror" has consumed enormous resources and restrained civil liberties but was not able to capture Osama Bin Laden or disintegrate Al Qaeda. Despite some initial sympathies for the United States after 9/11, the reputation of the US in the world has plummeted, even among NATO allies.
- The US Administration has blocked progress on nuclear disarmament. The Anti-Ballistic Missile Treaty has been abrogated and the START disarmament process was abandoned. The Non-Proliferation Treaty and the Biological & Toxin Weapons Convention are at stake. The Outer Space Treaty is disregarded, the Comprehensive Test Ban Treaty has not been ratified, and a Fissile Material Cut-off Treaty has not been agreed upon. The 2002 Moscow Treaty does not specify a nuclear reduction process and has no verification mechanism.
- The US has failed to make substantial investments into sustainable energy. Fossil fuel and nuclear energy paths have been promoted, contributing to future vulnerabilities.
- The US government has prevented major progress on fighting climate change, against the will of the large majority of the world. The additional carbon emissions over the past eight years will have lasting impacts over centuries and may trigger tipping points in the climate system. Climate change will likely threaten national and international security, as recent studies have analyzed. The International Panel on Climate Change (IPCC) has addressed serious risks that could undermine the living conditions of people all over the world. The degradation of natural resources, the decline of water and food supply, enforced migration, and more frequent and intense disasters will have severe security impacts. Climate-related shocks will add stress to the world's existing conflicts and act as a "threat multiplier" in already fragile regions. The 2007 Nobel Peace Prize to Al Gore and the IPCC indicates the growing relevance of the security-climate link.

In his recent book *The Seventh Decade*, Jonathan Schell asks why the threat of nuclear war receives much less public attention today than global warming, although both have a great deal in common: "Both put stakes on the table of a magnitude never present before in human decision making. Both threaten life on a planetary scale. Both require a fully global response. Anyone concerned by the one should be concerned with the other. It would be a shame to save the Earth from slowly warming only to burn it up in an instant in a nuclear war." Conflicts induced by climate change could create more incentives for nuclear proliferation. A nuclear arms race would waste resources and undermine cooperative solutions of climate change. Nuclear war itself would severely destabilize human societies and the environment, not to speak of the possibility of a nuclear winter.

The nuclear train is rolling towards the precipice, and more countries have joined the train in the past decade. Many more could acquire basic nuclear technology through the nuclear energy renaissance that is expected in response to growing energy needs and the decarbonization of energy supply. The only way to avoid nuclear disaster is to change the course of the nuclear train towards a nuclear-weapon-free world and make the transition towards a more secure and sustainable future. The world is waiting for the next President of the United States to make this change and move from the lost decade to a future decade of disarmament.

Some of the issues are covered in this volume. Steven Starr assesses the potential climatic consequences of a limited nuclear conflict. Andrew Lichterman highlights the future developments of nuclear weapons in the USA, and Erika Simpson discusses the implication of continued US reliance on NATO and the NPT. The possibly destabilizing link between Iran’s missile program (Bharath Gopalaswami) and the US missile defense in Eastern Europe (Jan Kavan) is analyzed by Jürgen Altmann and Götzt Neuneck.

Ways to leave the risky path are suggested in other contributions of the Bulletin. The transformation to a nuclear-weapons-free world through a Nuclear Weapons Convention (Jürgen Scheffran) provides an alternative to a continued nuclear and missile arms race, building on the updated Model NWC presented at the 2007 NPT conference. A technical analysis is given on the verifiability of a Fissile Materials Cut-off (Hui Zhang) and the environmental detection of uranium enrichment (Jens Bösenberg and Martin Kalinowski). Frank von Hippel and Richard Garwin describe their lifelong efforts to provide scientific input into the policy decision-making process. Forward-looking policy issues have been presented to the UN General Assembly by Jackie Cabasso and Rhianna Tyson.
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Catastrophic Climatic Consequences of Nuclear Conflict

STEVEN STARR

U.S. researchers have confirmed the scientific validity of the concept of “nuclear winter” and have demonstrated that any conflict which targets even a tiny fraction of the global nuclear arsenal against large urban centers will cause catastrophic disruptions of the global climate.

New studies show that a “regional” nuclear conflict, which targeted large population centers in the sub-tropics with 100 Hiroshima-size weapons – about 0.3% of the global nuclear arsenal –, could produce as many fatalities as World War II\(^1\) and would significantly disrupt the global climate for at least a decade.\(^2\) Following this “small” exchange, the world would rapidly experience cold conditions not felt since pre-industrial times.

U.S.-Russian arms accords have reduced by two-thirds the total number of nuclear weapons in the world’s nuclear arsenals since nuclear winter was first described in the 1980s. The new research confirms that the smoke produced by a war fought with the current global nuclear arsenal would still produce a nuclear winter.\(^3\) Under such conditions, daily minimum temperatures in the world’s large agricultural areas would fall below freezing for more than a year and cause the collapse of modern agriculture and the starvation of billions of people.

Nuclear Winter

Nuclear detonations within urban and industrial areas would ignite immense mass fires which would burn everything imaginable and create millions of tons of thick, black smoke (soot). This soot would ultimately be lofted into the stratosphere. There it would absorb and block sunlight from reaching the lower atmosphere where greenhouse gases mainly reside, and thus act to reduce the natural greenhouse effect.\(^4\)

The profound darkness and global cooling predicted to be result of this process (along with massive amounts of radioactive fallout and pyrotoxins;\(^5\) and ozone depletion) was first described in 1983 as nuclear winter.\(^6\) Joint research by Western and Soviet scientists led to the realization that the climatic and environmental consequences of nuclear war, in combination with the indirect effects of the collapse of society, could produce a nuclear winter which would cause famine for billions of people far from the war zones.\(^7\)

These predictions led to extensive international research and peer review during the mid-1980s. A large body of work which essentially supported the initial findings of the 1983 studies was done by such groups as the Scientific Committee on Problems of the Environment (SCOPE),\(^8\) the World Meteorological Organization,\(^9\) and the U.S. National Research Council of the U.S. National Academy of Sciences.\(^10\)

The idea of nuclear winter, published and supported by prominent scientists, generated extensive public alarm and put political pressure on the U.S. and the U.S.S.R. to terminate a runaway nuclear arms race which, by 1986, had created a global nuclear arsenal of more than 65,000 nuclear weapons. Unfortunately, this was anathema to the nuclear weapons establishment and thus nuclear winter created a backlash among many powerful conservative groups, who undertook an extensive media campaign to brand it as “bad science” and the scientists who discovered it as “irresponsible.”

Critics used various uncertainties in the studies and the first climate models (which are relatively primitive by current standards) as a basis to denigrate and reject the concept of nuclear winter. In 1986, the Council on Foreign Relations published an article by scientists from the National Center for Atmospheric Research (NCAR), who predicted drops in global cooling about half as large as those first predicted by the 1983 studies and described this as a ‘nuclear autumn.’

Subsequent widespread criticism, in such publications as the Wall Street Journal and Time Magazine, often used the term “nuclear autumn” to imply that no important climatic change would result from nuclear war. In 1987, the National Review called nuclear winter a “fraud.” In 2000, Discover Magazine published an article which described nuclear winter as one of “The Twenty Greatest Scientific Blunders in History.”\(^11\)

Sadly enough, for almost two decades this smear campaign limited serious discussion and prevented fur-
ther studies of nuclear winter – and such criticism will continue. Yet the basic findings of the nuclear winter research, that extreme climatic changes would result from nuclear war, were never scientifically disproved and have been strengthened by the latest studies.

Regional Nuclear Conflict Fought with Low-Yield Nuclear Weapons

To create the new studies, U.S. researchers used the latest NASA Goddard Institute for Space Studies climate model (Model 1E, also used for the Intergovernmental Panel on Climate Change), which is able to model the entire troposphere, stratosphere, and mesosphere from the Earth's surface up to 80 kilometers. They simulated a small nuclear war between two countries in the sub-tropics in which each nation attacked the other's most densely populated urban centers with 50 Hiroshima-size (15 kiloton per weapon) low-yield nuclear bombs.

This scenario is possible because the smallest nuclear weapon states today (India and Pakistan) are each believed to possess more than 50 of these low-yield weapons, and an arsenal of this size (or larger) could be acquired by other nations in the near future. Thirty-two countries that do not now have nuclear weapons own sufficient fissile nuclear materials to construct weapons, some in a relatively short period of time.

U.S. warplanners aim their extensive nuclear arsenal at a mix of military targets (nuclear forces, conventional forces, leadership and communication facilities, and war-supporting industries) and it is assumed that Russian warplanners do the same. However, it is commonly believed that small nuclear powers with limited arsenals are most likely to aim their weapons at the largest cities of their adversaries.

Toon et al. calculated that a "regional" nuclear war which employed this targeting strategy would create 1-5 million metric tons of soot from the burning cities. Robock et al. used the NASA climate model to demonstrate that this soot would be lofted to near the top of the stratosphere. There the smoke would remain, far above the area where weather occurs, for at least a decade – about ten times longer than previously thought possible.

Further modeling demonstrated that smoke particles from much larger nuclear conflicts would also remain in the upper stratosphere for a decade or more, and these findings provided the basis for rejecting the conclusion of the studies which suggested that “nuclear autumn” instead of nuclear winter would follow a full-scale war. Robock's team also discovered that smoke in the sub-tropical latitudes would undergo more solar heating than smoke studied in previous nuclear winter scenarios, and this heating would insure that the smoke particles would be lofted into the stratosphere year-round, regardless of the month in which the war would occur.

Consequently, the massive smoke emissions from the fires of a small "regional" nuclear war would cause a global climate change unprecedented in human history. In a matter of days, temperatures around the Earth would become colder than those experienced during the pre-industrial Little Ice Age (which occurred from approximately 1400 to 1850). Growing seasons in the middle latitudes would immediately be significantly shortened, completely eliminating some crops that had insufficient time to reach maturity.

The studies predict climatic consequences significantly greater and more persistent than those which resulted from the greatest volcanic eruption of the past 500 years, the 1815 Tambora eruption in Indonesia. Tambora lofted enormous amounts of volcanic smoke particles into the stratosphere, which blocked and scattered enough sunlight to cause the 1816 “Year Without Summer,” when killing frosts disrupted agriculture every month of the summer in New England and widespread harvest failure and famine occurred in Europe.

The long-term global climate, as measured by the average surface temperature over the planet, has not varied by more than 10° C from current values during the entire climatic history of the Earth accessible to modern science. Ice Ages represent periods of cooling of about 5° C below the global average which extend for periods of thousands of years. Modern agriculture is finely tuned to the present climate and would be severely impacted by rapid average temperature declines of even a few degrees Celsius.

Computer simulations of the regional nuclear conflict predict a global average surface cooling of 1.25° C which would persist for three years, with the global aver-
average temperature still 0.5°C below normal a decade after the war. One year after the smoke injection there would be temperature drops of several degrees Celsius within the grain-growing interior regions of Eurasia and North America. There would be a corresponding shortening of growing seasons by up to 30 days and a 10% reduction in average global precipitation – which would have major impacts on global food supplies.

In addition, the stratospheric smoke plumes from this regional conflict would significantly disrupt the ozone layer, depleting it by 40% over many inhabited areas and by up to 70-80% at the poles. This severe ozone depletion would allow intense levels of ultraviolet light to reach the Earth once the smoke cleared. Such levels of ozone loss have previously been forecast only for large nuclear conflicts between the U.S. and the former U.S.S.R.

Nuclear War Fought with High-Yield Strategic Nuclear Weapons

Using the vastly more modern NASA climate model and new supercomputers, Robock et al. re-examined the climate response to a range of nuclear wars which detonated moderate and large portions of the global nuclear arsenal in a combination of urban, industrial, and military targets. The researchers utilized data from previous studies to calculate that the “moderate” and “large” nuclear conflicts would produce 50 and 150 million tonnes of smoke, which they found would be lofted into the stratosphere, where it would impact surface climate for more than a decade.

The moderate war simulation employed one third of the global nuclear arsenal (1,667 megatons) – roughly equivalent to the power of the strategic nuclear weapons now kept at high-alert, launch-on-warning status by the U.S. and Russia. The large war simulation used the current published estimate for the total explosive power of the entire global nuclear arsenal (approximately 5,000 megatons). However, the 5,000 MT figure appears to be low because it significantly underestimates the explosive power of the Russian reserve stockpile.

A large nuclear war would produce enough smoke and soot to quickly block sunlight from reaching the surface of the entire Northern and Southern Hemispheres. In many areas sunlight would be reduced so much that at mid-day it would appear as dark as a moonlit night before the war. The smoke and darkness would persist for years.

This profound darkening of the sky would cause average global surface air temperatures to rapidly cool by 7–8°C. Even a decade after the fires had gone out, there would be enough smoke left in the stratosphere to cool the Earth’s average surface temperatures by 4°C. Both the moderate and large nuclear wars would produce cooling...
equal to or greater than that experienced 18,000 years ago during the coldest period of the last Ice Age32 – and these temperature drops would occur abruptly in a matter of days or weeks, rather than over centuries or millennia.

The research predicts that a war in which the entire global nuclear arsenal was detonated would result in rapid cooling of more than 20° C over large areas of North America and of more than 30° C over much of Eurasia, including all agricultural regions (Figure 2). Daily minimum temperatures in the world’s agricultural heartlands would plummet below freezing and nightly frosts would go on for more than a year.

Longer-term consequences of the large nuclear conflict are implied by Figure 3, which depicts predicted decreases in the growing seasons during the third year following the conflict.

Agriculture would be affected by not only the catastrophic drops in temperature, but also by a dramatic decrease in sunlight (insolation) and precipitation. The cooling of the Earth’s surface would weaken the global hydrological cycle and the Northern Hemisphere summer monsoon circulations would collapse because the temperature differences that drive them would not develop. Consequently, a 45% reduction in average global precipitation is also predicted to occur. Catastrophic climatic effects lasting for many years would occur in regions far removed from the target areas or the countries involved in the conflict.35

Nuclear War Fought with U.S. and Russian High-Alert Strategic Nuclear Arsenals

The failure of the U.S. and Russia to relax their Cold War nuclear confrontation has led each nation to continue to operate under policies that assume the opposing side could authorize a disabling nuclear attack against them. Both nations consequently still maintain a large fraction of their strategic nuclear arsenals on high-alert status, with their intercontinental missiles able to be launched within 30 seconds to 3 minutes, apparently operating under the policy of launch-on-warning.36 Thus the moderate war simulated in the new research, which as noted contains a destructive power equivalent to that contained by these high-alert arsenals, can be ordered and executed by either of these nations in less time than it takes to read this article.

The studies predict that a moderate nuclear war would loft 50 million metric tonnes of soot in the stratosphere, causing average global surface air temperatures to plummet 3.5–4° C, roughly half the drop predicted for the large war.37 Consider that average global temperature declines of 3–4° C would prevent all grain production in Canada, and a single night below freezing is sufficient to destroy the entire Asian rice crop.38 Because of its rapid onset, even a mild nuclear winter (although the duration would be much briefer) would cause more stress to plant and animal life than would a severe Ice Age.39

Figure 3: Changes in the growing season (the time period with frost-free days) in the third year following a large scale nuclear war which used all the weapons in the global nuclear arsenal34

\[ \text{NH Change in Growing Season (days) Year 3} \]

\[ \text{SH Change in Growing Season (days) Year 3–4} \]
Climatic Consequences of Nuclear Conflict Compared with Global Warming

Climatic changes resulting from nuclear conflict would occur many thousands of times faster – and thus would likely be far more catastrophic – than the climatic changes predicted as a result of global warming. The rapidity of the war-induced changes, appearing in a matter of days and weeks, would allow human populations and the whole plant and animal kingdoms no time to adapt.

It is worth noting that the same methods and climate models used to predict global warming were used in these studies to predict global cooling resulting from nuclear war. These climate models have proved highly successful in describing the cooling effects of volcanic clouds during extensive U.S. evaluations and in international intercomparisons performed as part of the Fourth Assessment of the Intergovernmental Panel on Climate Change.

Predicted drops in average global temperatures caused by small, moderate, and large nuclear conflicts are contrasted with the effects of global warming during the last century in Figure 4 and with average surface air temperatures during the last 1,000 years in Figure 5.

There are, of course, other important considerations which must be made when estimating the overall environmental and ecological impacts of nuclear war. These must include the release of enormous amounts of radioactive fallout, pyrotoxins, and toxic industrial chemicals into the ecosystems. A decade after the conflict, when the smoke begins to clear, there will also be massive increases in the amount of deadly ultra-violet light which will reach the surface of the Earth as a result of ozone depletion. All these by-products of nuclear war must be taken into account when comparing the danger of nuclear conflict to other potential dangers now confronting humanity and life on Earth.

Conclusions

We cannot allow our political and military leaders to continue to ignore the potential cataclysmic climatic and environmental consequences posed by the use of nuclear weapons.

Civilization remains at risk from nuclear winter despite a three-fold reduction in global nuclear arsenals during the last 20 years. This is due in part to the fact that nuclear arms control agreements have focused primarily on the dismantlement of delivery systems and have failed to include the verified dismantlement of nuclear warheads. Future negotiations...
must consider all the potential effects of the total number of nuclear weapons in the nuclear arsenals.\textsuperscript{44}

The U.S. and Russia must recognize the senselessness of continued planning for a nuclear first-strike which, if launched, would make the whole world including their own country uninhabitable. As a first step, they should end their preparations for the pre-emptive use of their nuclear arsenals, stand-down their high-alert strategic nuclear forces, and eliminate the standard operating procedure of launch-on-warning.\textsuperscript{48}

It is essential that all the nuclear weapon states be convinced of the need to honor their commitments under Article VI of the Non-Proliferation Treaty, to “act in good faith” to eliminate their nuclear arsenals. As long as they ignore this commitment and maintain nuclear weaponry as the cornerstone of their military forces, they confer validity to the false idea that nuclear weapons provide security to those who possess them, and thus encourage non-nuclear weapon states to follow in their footsteps.

The unalterable conclusion is that a nuclear war cannot be won and must not be fought. Nuclear weapons must be seen not only as instruments of mass murder, but as instruments of global annihilation which put all humanity and civilization under a common threat of destruction.


4 Water vapor, carbon dioxide, methane, and nitric oxide are the main greenhouse gases in the atmosphere. They allow short wavelength solar radiation to reach the Earth but absorb radiation of longer wavelength, which causes warming of the atmosphere. This process occurs naturally and has kept the Earth’s temperature about 33 Celsius degrees (59 Fahrenheit degrees) warmer than it would otherwise be. Current life on Earth could not be sustained without the natural greenhouse effect.

5 A term to designate toxic chemicals released during combustion, particularly from plastics and industrial chemicals. In a nuclear war, sources of such materials would be widespread; mass fires in urban and industrial areas would release enormous amounts of pyrotoxins into the air, land, and water.


14 Toon et al., p. 1974.


16 Toon et al., p. 1998.


18 Robock et al., \textit{Nuclear winter revisited…}, op.cit., pp. 1-7 of 14.


20 Robock et al., \textit{Climatic consequences…}, op.cit., p. 2007.


22 Figure 4.8a on p. 302 of SCOPE Report 28, Vol. II, op.cit.


26 There are approximately 25,300 nuclear weapons in the global nuclear arsenal; 95% of these weapons belong to the U.S. and Russia. About 11,800 of these weapons are fully operational
wepons ready for immediate use. An additional 13,500 intact nuclear weapons are in a 'reserve' status. About 7,200 of the operational weapons are high-yield strategic nuclear weapons with ≥100 kiloton yield, i.e., having an explosive power equal to or greater than 100,000 tons of high explosive.

27 Robock et al., *Nuclear winter revisited..., op.cit.*, state that this is the greatest area of uncertainty in their calculations, but note that the amount of smoke affects the amplitude but not the timescale of the climatic response, p. 12 of 14.

Ibid., p. 3 of 14.

29 Approximately 3,500 to 4,000 U.S. and Russian strategic nuclear warheads remain on high-alert status. These include a very high percentage of the warheads on (1) U.S. and Russian land-based intercontinental ballistic missiles, (2) Russian ballistic missile submarines (which remain in port virtually all of the time), and (3) all the warheads on the four U.S. Trident submarines which are always kept at 'hard alert' status, in position to fire. The total yield of these U.S. and Russian high-alert strategic nuclear forces is the range of 1,300 MT to 1,700 MT, which is roughly equivalent to the explosive power of the 1,667 MT model used in the simulations.

30 The 5,000 MT figure comes from the Carnegie Endowment for International Peace (www.carnegieendowment.org/npp/index.cfm?fam=map&id=19238&prog=zgpp&proj=znpp). They based their figures on data from the National Resources Defense Council (NRDC). Current NRDC Notebook data (from *The Bulletin of the Atomic Scientists*) estimates about 2,500 MT yield for the entire U.S. arsenal; about 300 MT yield for the entire Chinese, French; and U.K. arsenals; and about 1,350 MT yield for the operational Russian arsenal; but no figure is available for the yield of the Russian reserve arsenal, although the NRDC estimates that 9,300 weapons are in the Russian reserve. Hans Kristensen of the Federation of American Scientists estimates that the Russian reserve has equal numbers of strategic and tactical weapons. Assuming an average Russian strategic weapon is 550 KT and a tactical weapon is 50 KT, then the yield of the Russian reserve must be about 2,790 MT. This increases the yield of the global arsenal to about 7,000 MT.

31 Personal correspondence with Alan Robock, Sept. 9, 2007.

32 Robock et al., *Nuclear winter revisited..., op.cit.*, p. 6 of 14.

Ibid., Figure 4.

34 Ibid., Figure 10.


36 Launch-on-warning (LOW) is the Cold War policy of launching a retaliatory nuclear strike while the opponent’s missiles or warheads are believed to be in flight, but before any detonation from the perceived attack has occurred. Early Warning Systems (EWS), high-alert nuclear-armed ballistic missiles, and nuclear command and control systems, all working together, provide the U.S. and Russia the capability to launch a nuclear retaliatory strike to a perceived nuclear attack before the attack arrives and is confirmed by nuclear detonations. However, it is the policy of Launch on Warning, converted into standard operating procedure, which could lead to the decision to launch solely on the basis of electronic EWS data. The combination of capability with policy has created what is commonly referred to as launch-on-warning status.

37 Robock et al., *Nuclear winter revisited..., op.cit.*, p. 7 of 14.


40 This comparison is not meant to minimize the dangers of global warming, which warrant grave concern, rather it is intended to make the point that the potential environmental dangers posed by nuclear war should receive at least as much attention as is that now being afforded to the issue of global warming.

41 Robock et al., *Nuclear winter revisited..., op.cit.*, p. 11 of 14.


43 Ibid.


**STEVEN STARR** is an independent writer who has been published by the Bulletin of the Atomic Scientists and the Moscow Institute of Physics and Technology Center for Arms Control, Energy and Environmental Studies; sstarr@centurytel.net.
March 19, 2008, marks the fifth anniversary of the U.S. invasion and occupation of Iraq, a war launched on the pretext of ending a nuclear weapons program that did not exist. This Spring, the U.S. Department of Energy is holding hearings and taking public comment on its current plan to modernize the very real laboratories and factories where the U.S. designs, builds, and maintains nuclear weapons. This plan would allow the government to keep thousands of nuclear weapons for many decades to come, and to build thousands more should it choose to do so.

The focus for the public hearings and comment process is an Environmental Impact Statement (EIS) for what now is called “Complex Transformation.” This is the latest label for the ongoing work of rebuilding nuclear weapons research facilities and manufacturing plants worn out and heavily contaminated by the manufacture of tens of thousands of nuclear weapons over more than six decades, starting with the World War II Manhattan Project.

The purpose behind these plans is to retain U.S. dominance in nuclear weapons for the foreseeable future, with the ability to expand production capacity and to design and deploy new kinds of nuclear weapons if desired. The Commander of U.S. Strategic Command, General Kevin Chilton, recently told reporters that “As we look to the future – and I believe we are going to need a nuclear deterrent for this country for the remainder of his century, the 21st century – I think what we need is a modernized nuclear weapon to go with our modernized delivery platforms.”1 The EIS describes the “Complex Transformation strategy” as requiring “a responsive infrastructure to design, develop, and field new weapon systems if needed.”2 At the same time, the missiles and aircraft that deliver nuclear weapons to their targets also are being modernized, and new generations of delivery systems are in development. The goal, as a 2002 Air Force planning document put it, is to “prepare the US for an uncertain future by maintaining US qualitative superiority in nuclear warfighting capabilities in the 2020–2040 time frame.”3

Today, the work of designing, building, and maintaining U.S. nuclear bombs and warheads is done at eight sites in seven states. The laboratories at Los Alamos, New Mexico and Livermore, California do weapons research and design and a variety of tasks to keep existing nuclear weapons ready to go. The Los Alamos Lab also makes the plutonium “pits” that are the atomic trigger for thermonuclear weapons. The Sandia laboratories, in Albuquerque, New Mexico and Livermore, California, do engineering work on nuclear weapons and design and manufacture non-nuclear components. All three laboratories also conduct non-nuclear military research. The Nevada Test Site, where over a thousand nuclear weapons were exploded in the atmosphere and underground before the 1992 testing moratorium, continues to be used for underground experiments called “subcritical” tests that do not have a significant nuclear yield. These tests further develop nuclear weapons knowledge and help to keep the test site ready to resume full-scale nuclear testing if desired.

The remaining parts for nuclear weapons are manufactured at plants across the country. The Y-12 plant at Oak Ridge, Tennessee makes uranium parts and other components, including the “secondaries” that provide the fuel for the thermonuclear blast triggered by the explosion of the plutonium primary in most modern nuclear weapons. The Kansas City plant in Missouri makes and tests non-nuclear components. Georgia’s Savannah River facility extracts tritium, a radioactive isotope of hydrogen used to increase nuclear weapons yield, and fills the tritium containers for nuclear weapons. The Pantex plant in Amarillo, Texas assembles, modifies, and dismantles nuclear weapons, and also makes high explosive components.

The most important decisions addressed by the Complex Transformation EIS concern the modernization or replacement of factories to make the core components for nuclear weapons: the plutonium pits and the secondaries. The government wants to build additional facilities at Los Alamos to provide an “interim capability” for pit production, whether or not a new, larger factory will be located there for the long term. Los Alamos is the first choice for a new plutonium pit factory, and the Y-12 plant at Oak Ridge the preferred option for production of secondaries and other uranium components. Other locations under consideration for both uranium and plutonium factory operations include Savannah River, Pantex, and the Nevada Test Site.

The Complex Transformation EIS considers alternatives that would allow from 50 to 200 plutonium pits to be produced every year. Fifty nuclear weapons are enough to drop the bomb on every American city with a population over 350,000, from New York and Los Angeles to Austin, Cleveland, and Colorado Springs.
Almost two decades after the end of the Cold War, the U.S. deploys a force of nuclear weapons and delivery systems originally designed to destroy as much as possible of Russia’s nuclear arsenal before it could get off the ground. A thousand or more U.S. nuclear warheads stand ready to go in minutes atop missiles launched from silos in the U.S. Mid-West and from Trident submarines still perpetually patrolling the seas. Many more could be delivered by aircraft. All told, the U.S. still has close to 10,000 nuclear weapons, about half of them actively deployed. The U.S. plans to cut the numbers of deployed strategic warheads in half by 2012, pursuant to 2002 Moscow Treaty. That treaty, however, does not require the destruction of a single missile, bomber, or ballistic missile submarine.

Further, a central goal of U.S. planners is to allow the reconstitution of a larger nuclear arsenal should U.S. decision makers choose to do so. As the head of the National Nuclear Security Administration recently described it, “…the deterrent won’t be the old Cold War model based on numbers of weapons, rather it will be the capability to respond to any national security situation and produce those weapons if necessary.”

What do these numbers really mean? General George Lee Butler, retired commander of U.S. Strategic Command, emphasized that “it is imperative to recognize that all numbers of nuclear weapons above zero are completely arbitrary; that against an urban target one weapon represents an unacceptable horror; that twenty weapons would suffice to destroy the twelve largest Russian cities with a total population of twenty-five million people – one-sixth of the entire Russian population; and therefore that arsenals in the hundreds, much less in the thousands, can serve no meaningful strategic objective.”

An additional goal of Complex Transformation is to “[i]mprove the capability to design, develop, certify, and complete production of new or adapted warheads in the event of new military requirements.” The push by elements inside and outside the government for nuclear weapons with new military capabilities slowed after the end of the Cold War, with Congress placing some restrictions on research on nuclear warheads and an official Clinton Administration policy of no “new” nuclear weapons. Despite this policy, U.S. nuclear weapons research continued throughout the 1990s. These efforts had two goals: to develop the capacity to destroy difficult types of targets, and to design nuclear weapons that would be politically feasible to use. The B61-11, an earth penetrating version of an existing nuclear bomb with a variable yield, was developed in the late 1990s without a full-scale underground test, using just the component testing and computer simulation capabilities of the nuclear weapons laboratories.
With the ascendance of the Bush Administration, the push for nuclear weapons with new military capabilities intensified. The 2001 Bush Nuclear Posture Review (NPR), a major policy document that outlined plans for strategic weapons development, stated that “There are several nuclear weapon options that might provide important advantages for enhancing the nation's deterrence posture: possible modifications to existing weapons to provide additional yield flexibility in the stockpile; improved earth penetrating weapons (EPWs) to counter the increased use by potential adversaries of hardened and deeply buried facilities; and warheads that reduce collateral damage.”

Congress has swung back and forth regarding the development of nuclear weapons with new military capabilities, sometimes providing explicit funding for “new” nuclear weapons programs (such as for a “Robust Nuclear Earth Penetrator” and for nuclear weapons “Advanced Concepts” research) and later cancelling those programs, while keeping general program funding for nuclear weapons research and development programs relatively stable. Congress with little dissent has funded “life extension” programs for existing nuclear weapons, programs that have modernized those weapons and in some cases upgraded their military capabilities.

The most recent “new weapons” initiative is the “Reliable Replacement Warhead” (RRW) program. Its goal is to obtain greater reliability by combining modern manufacturing techniques with greater design margins, in some circumstances taking advantage of less demanding requirements in terms of yield and weight than was deemed necessary for some Cold War missions. Congress cut funds designated for RRW work in fiscal year 2008, but the Bush Administration is pushing hard for renewed funding in the fiscal year 2009 budget, claiming that it “would offer means to transform to a more efficient and responsive, much smaller, and less costly nuclear weapons R&D [research and development] and production infrastructure.”

At the same time, the military is modernizing the missiles and bombers that carry U.S. nuclear weapons and their supporting infrastructure, with upgrades of everything from missile guidance systems to the computer hardware and software used to plan and execute nuclear strikes. The 2006 Quadrennial Defense Review called for a “new land-based, penetrating long-range strike capability to be fielded by 2018 while modernizing the current bomber force.”

The endless quest for nuclear superiority is part of the larger gamble that U.S. elites are making with all our futures: that the pursuit of global military dominance will allow them to shore up their slipping economic hegemony for a few decades more. Nuclear weapons ultimately back massive U.S. conventional forces and an aggressive military posture worldwide. As the Air Force Strategic Planning Directive for Fiscal Years 2006–2023 made clear, nuclear weapons provide “…a credible deterrent umbrella under which conventional forces operate and, if deterrence fails, strike a wide variety of high-value targets with a highly reliable, responsive and lethal nuclear force…” Desired effects include: Freedom for U.S. and Allied forces to operate, employ, and engage at will…"

All of this is taking place in a context where the United States has a policy – and a demonstrated practice – of preventive war-making, with the “proliferation” of nuclear weapons ranking first on the list of public rationales for war. While it ignores its own nuclear Non-Proliferation Treaty obligation to negotiate the elimination of its nuclear arsenal, the U.S. government claims the right to attack any state it chooses to portray as a nuclear danger. With the Iraq war, we saw how easily that threat could be used as the core of a propaganda campaign for a war of aggression. With the relentless effort to portray Iran as an imminent nuclear threat, we see the arrogance of violent, undemocratic elites who believe that they can get away with it again.

Nuclear weapons continue to pose fundamental threats to human security. They play a key role in sustaining the global climate of fear that justifies militarism and military industrial complexes everywhere. Their manufacture contaminates the earth with radioactive materials that can last for thousands of years. Their continued existence in a global context that increasingly resembles those that have brought major wars between rising and declining centers of economic power in the past poses a risk of nuclear catastrophe that may be greater than we faced during the Cold War. The U.S. plan to rebuild its nuclear weapons complex is an appropriate focus for bringing some of the forces that drive us to war to light – and to say no to this war, and the next.

References
New Opportunities to Question US Reliance upon Nuclear Weapons

ERIKA SIMPSON

There is a fear among many North Americans and Europeans that the United States Administration could resort to using nuclear weapons in a future conflict. While other nuclear weapons States – Russia, China, France, and Britain – officially retain nuclear weapons in their stockpiles, it is the American use of new theatre and battlefield nuclear weapons that seems more likely to occur. This perception stems from the Bush Administration’s seemingly greater willingness to resort to the use of its arsenal. This has been reflected clearly in the policy decisions of the Administration and its declaration that: “Given the goals of rogue states and terrorists, the United States can no longer solely rely on a reactive posture as we have in the past... To forestall or prevent such hostile acts the US will, if necessary, act pre-emptively.”

This article argues that the ‘new’ U.S. doctrine with its emphasis on pre-emptive strikes is dangerous and has broad implications for NATO’s traditional Strategic Concept, which regards nuclear weapons as ‘essential.’ Behind-the-scenes, defense policy-makers in Washington and at NATO headquarters in Brussels are beginning to discuss whether the Strategic Concept should somehow be revised by the U.S. and its NATO allies, perhaps in time for NATO’s sixtieth anniversary in 2009. The 2008 U.S. presidential election process and the two Preparatory Committee meetings leading up to the nuclear Non-Proliferation Treaty (NPT) Review Conference in 2010 also present significant opportunities to re-examine the United States’ reliance on nuclear weapons. In doing so, questions should also be raised about the other nuclear weapons States’ emphasis upon nuclear weapons. Imminent ‘change’ in the American political scene presents the international arms control and disarmament community with some unprecedented opportunities to effect change in U.S. and NATO nuclear doctrine over the next two years.

Dangerous Attitudes toward Pre-emptive Nuclear War

In early 2002, the Bush Administration declared in its National Security Strategy that the U.S. could no longer
rely solely on a ‘reactive’ posture as it had in the past. The U.S. would, if necessary, act ‘pre-emptively’ to forestall or prevent hostile acts by rogue states and terrorists. Its increased or ‘new’ emphasis on pre-emptive doctrine was strongly criticized by many politicians and scholars. However, despite this criticism, the current government asserted essentially the same policy in its 2006 National Security Strategy:

“The U.S. has long maintained the option of preemptive actions to counter a sufficient threat to our national security. The greater the threat, the greater is the risk of inaction – and the more compelling the case for taking anticipatory action to defend ourselves, even if uncertainty remains as to the time and place of the enemy’s attack. To forestall or prevent such hostile acts by our adversaries, the United States will, if necessary, act preemptively.”

Arguably, the U.S. and Western Alliance’s concepts of nuclear deterrence and nuclear pre-emption must move away from the traditional notion of ‘defending’ against threats – such as strategic or tactical nuclear weapons – and away from the newer notion of ‘offensively’ using pre-emptive nuclear strikes. Instead, the emphasis must be placed on achieving ‘minimal’ nuclear deterrence and, eventually, nuclear abolition. If the U.S. continues on its present trajectory – threatening to respond to or pre-empt a nuclear, biological, or chemical attack, possibly with nuclear weaponry – it may incite an arms race where states and sub-state actors seek to deter, or pre-empt, using all sorts of newer weapons, including expensive options ranging from enhanced radiation weapons to satellites in space to nuclear-survivable communications systems. The costs for the world will continue to be enormous as countries compete to design weapons for use against possibly un- terrable terrorists, on rogue state battlefields, and in outer space. As a statement on nuclear weapons policy issued by the board of the Nuclear Age Peace Foundation states: “It is the US insistence on retaining a nuclear weapons option that sets the tone for the world as a whole… In this post-September 11th climate, the U.S. has suddenly become for other governments a country to be deterred rather than, as in the Cold War, a country practicing deterrence to discourage aggression by others.”

Reassessing NATO’s Reliance on Nuclear Deterrence

The United States’ allies need to ask themselves in the months leading up to NATO’s sixtieth anniversary in 2009 and the 2010 NPT Review Conference whether nuclear weapons actually offer protection. Does the possession of nuclear weapons deter potential aggressors from attacking? Curiously, the leaders of the non-nuclear weapon states in NATO continue to profess their reliance on traditional nuclear deterrence, while the U.S. moved five years ago toward a pre-emptive strategy that promises to strike first with nuclear weapons, even in the event of a limited chemical or biological attack. The situation is similar to the late 1950s and 1960s when all the NATO allies continued to rely upon one permutation of nuclear deterrence – mutual assured destruction or MAD – even as the U.S. developed another permutation called ‘flexible response.’

To clarify, NATO’s ‘new’ Strategic Concept (asserted in 1991 and reissued in 1999) links the non-nuclear weapon states in NATO to the overall nuclear policies of the NATO nuclear weapon states by asserting that, “The supreme guarantee of the security of the Allies is provided by the strategic nuclear forces of the Alliance, particularly those of the United States; the independent nuclear forces of the United Kingdom and France, which have a deterrent role of their own, contribute to the overall deterrence and security of the Allies.” The Strategic Concept directly implicates the NATO non-nuclear weapon states in NATO’s nuclear plans and force posture:

“A credible Alliance nuclear posture and the demonstration of Alliance solidarity and common commitment to war prevention continue to require widespread participation by European Allies involved in collective defence planning in nuclear roles, in peacetime basing of nuclear forces on their territory and in command, control and consultation arrangements. Nuclear forces based in Europe and committed to NATO provide an essential political and military link between the European and the North American members of the Alliance. The Alliance will therefore maintain adequate nuclear forces in Europe.”

Recent interviews at NATO headquarters indicate some sort of in-depth review of NATO’s nuclear doctrine may be forthcoming, perhaps in time for NATO’s sixtieth anniversary celebrations in 2009. Changes in the Strategic Concept may also be expected preceding or in the wake of changes in the U.S. Administration. We need to remember that efforts to change NATO’s deterrent policy can be initiated at the nation-state level. The thrust for NATO’s 1999 review essentially began because Canada’s parliament released a report calling for a re-examination of NATO’s reliance on nuclear deterrence and the Strategic Concept. Canada’s former Foreign Minister Lloyd Axworthy committed his department to attempt to change NATO’s nuclear doctrine. Working together with Joschka Fisher, the German Foreign Minister, these critics of NATO policy attempted to persuade NATO diplomats that the Alliance needed to reconsider its reliance on nuclear weapons for deterrence purposes. In the final analysis, even American diplomats at NATO Headquarters were impressed
with the Canadian/German initiative and the determina-
tion of the Canadian Foreign Minister and his diplomatic aides. In a similar fashion, working together with other like-minded ‘middle powers’ in NATO, such as Germany, Norway, Belgium, and the Netherlands, it might be possible to revise NATO’s nuclear doctrine.

The 2005 NPT Review Conference

Prior to the 2005 NPT Review Conference, the Middle Powers Initiative and Pugwash Canada, the national affiliate of the Pugwash International Conferences on Science and World Affairs, held several roundtables for Canadian officials and representatives of non-governmental organizations. They recommended strengthening the ‘moderate middle’ of the debate so as to bring ‘moderate’ NATO states and New Agenda Coalition states together in support of a strategy to bridge the growing gap between ‘dis-
armament’ and ‘non-proliferation’ elements in the NPT review process. The Middle Powers Initiative under the leadership of its chair, Canadian Senator Douglas Roche, organized strategy sessions, roundtables, and conferences with support from a huge variety of organizations, ranging from the International Pugwash Conferences to the Jimmy Carter Center in Atlanta, Georgia. With a view to strengthening the entire nuclear non-proliferation regime, most of the energy and focus centred around preparations for the 2005 Review Conference. Was this a tactical error?

Unfortunately, the talks in the various NPT Prepa-
ratory Committee meetings failed heralding the actual collapse in acrimony of the 2005 Non-Proliferation Treaty Review Conference. The abysmal failure of diplomats from 188 nations to agree to anything at all – not a single document or proposal – meant that the NPT reached its greatest crisis point since its inception in 1968. In fact, the entire nuclear non-proliferation regime faced its greatest threat ever, augmented by the United States’ decision to pull-out of the Anti-
Ballistic Missile Treaty and to renege from signing the Comprehensive Test Ban Treaty (CTBT). The blame for this sorry state of affairs was placed squarely by countries in the Non-Aligned Movement on the U.S. Administration, even as they begin thinking about possibly acquiring nuclear weapons of their own. The fact that nobody could agree on any proposals to reign in Iran and North Korea meant that these two countries could be perceived as having implicitly obtained the ‘go-ahead’ to acquire their own nuclear arsenals. The world’s citizens faced the frightening prospect of a world of nuclear ‘haves’ and ‘have-nots’ where possession of nuclear weapons was perceived as justifiable, even a normal state of affairs. Evidently diplomats had wasted precious time at this NPT Review Conference arguing about diplomatic wording instead of solving pressing nuclear problems; moreover, a disturbing precedent was set for any future arms control and disarmament conferences.

The 2010 NPT Review Conference and the Middle Powers Initiative

The two upcoming Preparatory Committee meetings and the eighth Review Conference of the NPT in 2010 face incredibly daunting challenges. Arguably, the original nuclear weapons states (U.S., Russia, UK, France, and China) have not lived up to their obligations under Article VI of the NPT to move decisively toward the irreversible elimination of their nuclear arsenals. Such inaction has already invited charges of hypocrisy – particularly as some of these same countries seek to deny access to nuclear technologies by non-nuclear weapon states, like Iran, or, in the case of the U.S., threaten to carry out military pre-emption to prevent the acquisition of nuclear weapons by other countries.

It therefore seemed imperative that the Middle Pow-
ers Initiative undertake a series of international consulta-
tions (the so-called Article VI Fora) through which mid-
dle powers and non-nuclear weapon states could build support for a series of achievable measures. Also, with the support of the Pugwash Conferences on Science and World Affairs, a high-level roundtable on The Impera-
tive of Revitalizing Nuclear Disarmament was held on the occasion of Pugwash’s fiftieth anniversary celebrations in Bari, Italy, in October 2007.

Just as middle powers like Canada and Germany previously took the lead to ask NATO to review its reliance on deterrence, it may be possible for middle powers to play a significant role in questioning the reasons for and implications of the United States’ emphasis on the doctrine of pre-emptive nuclear warfare, along with the problems emanating from the other great powers’ continued reliance on traditional nuclear deterrence.

Problems with Traditional Assumptions about Nuclear Deterrence

The United States’ allies need to ask themselves in the months leading up to NATO’s sixtieth anniversary and the 2010 NPT Review Conference whether nuclear wea-
pons protect them by deterring potential aggressors from attacking. During the Cold War, strategists assumed that by threatening massive retaliation, nuclear weapons could credibly prevent an enemy from attacking. September
11th demonstrated that there are no guarantees that the threats of pre-emption or retaliation will succeed in preventing an attack – indeed, it may be difficult to retaliate against a sub-state opponent, like a terrorist group. Moreover, traditional arguments against classical deterrence still hold true. There are many ways that deterrence and/or pre-emption could fail, including misunderstanding, miscalculation, poor communication, irrational leadership, and accident.  

The problem is that although non-nuclear weapon states in NATO and the New Agenda Coalition are questioning the efficacy of relying upon deterrence – and strengthening the ‘moderate middle’ of the debate – there is little likelihood that hard-line strategists at different ends of the spectrum will come to the same conclusion. This is partly because it is difficult to give up long-held assumptions. Will this generation of strategic decision-makers have to retire or die before they can relinquish their convictions about deterrence?

It is notable that in each of Christopher Columbus’ four voyages between 1492 and 1504, Columbus believed that “he had reached Asia, he was in Asia, and it was from Asia he returned. No one, nothing, to the day of his death, ever made him relinquish that cherished conviction.”

Similarly, many senior defence decision-makers in the upper echelons of nuclear policy-making continue to surmise that traditional concepts underlying nuclear deterrence have succeeded simply because there was no large-scale nuclear war between the U.S. and the Soviet Union during the Cold War. It was not until after 9/11 that strong advocates of deterrence from the ‘New Right’, like President Bush, Vice-President Cheney, and Secretary of Defense Rumsfeld, came to reluctantly recognize that deterrence could fail to work with sub-state actors and a more credible alternative was needed. However, instead of moving away from the traditional notion of defending against threats through deterrence, they embraced the new notion of ‘offensively’ or credibly threatening to use pre-emptive strikes, possibly nuclear weaponry. They chose to reissue the National Security Strategy of 2002 in essentially its same form in 2006, despite widespread international criticism.

Alternatives to Pre-emptive Nuclear Strikes And ‘First Use’

Since all the NATO allies depend on a relationship of ‘extended deterrence’ with the U.S. (even if they profess to be nuclear-weapon free on their own soil), it is incumbent upon each of them to examine ‘new’ and older U.S. ideas about ‘first-use’ and pre-emptive warfare. This should be done with a view to generating a much-greater range of alternative strategies, from reassurance to coercion. Every region of the world, not just those under NATO auspices, needs to develop more ideas about alternatives to nuclear first use. We need to improve treaty verification; increase funding for inspection regimes; improve cutting-edge technologies; develop more-effective sanctions; and enhance control over fissile materials. History shows that first steps towards regional, then global security can be taken by individual leaders through regional organizations, like NATO, the Non Aligned Movement, the Middle Powers Initiative, and International Pugwash. It is imperative that each NATO ally reconsider its reliance on extended deterrence and pre-emptive nuclear strikes in light of the new types of threats and challenges the international community now faces.

Conversely, some significant obstacles to undertaking such reforms revolve around the continuing lack of consensus about NATO’s collective security guarantees.

NATO’s Collective Security Guarantees

The NATO allies responded swiftly to the September 11 terror attacks, invoking Article V – the collective defence provision – of the 1949 Washington Treaty the following day. Apparently all the NATO allies were in agreement about the necessity of a collective response to the attack on America. However, the atmosphere of consensus dissipated shortly before the U.S. attack on Iraq in March 2003. France, Germany, and Belgium imposed a veto on the commencement of military planning to defend Turkey, another member state, in the event of hostilities with Iraq. To date, the effects of the Franco-German rebuff have been considerable. For example, former members of the Warsaw Pact that have either joined or hoped to join the Alliance are asking whether France and Germany might be prepared to veto NATO countermeasures to help them in the event of a crisis? These countries are particularly dependent on NATO’s collective security guarantee because they are being asked to give up much of their all-round and outdated defensive capabilities in order to contribute specialist skills. All the allies need to engage in a discussion about when and how Article V provisions will protect them during a crisis. In the context of a debate about Article V in NATO’s charter and Article VI in the NPT, it will be important to engage in a no-holds-barred discussion about America’s new pre-emptive strategy and its implications for the other NATO allies, all of whom shelter under the American nuclear umbrella, even if they claim to be nuclear-weapon free zones.
American Unilateralism and Heavy-Handedness

Yet another fall-out of the war against Iraq relates to perceptions of American heavy-handedness. For example, at one point U.S. Secretary of Defense Donald Rumsfeld threatened to pull NATO headquarters out of Brussels. The Bush Administration’s propensity to threaten its NATO allies with extreme measures was most telling in its decision to suspend military assistance to six nations seeking NATO membership because they failed to exempt American citizens from prosecution in the new International Criminal Court. The Bush Administration has taken a more aggressive approach than has ever been seen in NATO corridors. And, because of this, open, unfettered discussion about America’s new pre-emptive strategy and its implications for the other NATO allies is very unlikely, at least until a new U.S. President is elected later this year.

The Opportunities Presented by the U.S. Presidential Election

It is notable that the Democrat’s previous presidential candidate in 2004, John Kerry, appealed to American citizens to vote for him because “I believe America is safest and strongest when we are leading the world and we are leading strong alliances.” Kerry seemed to tap a strong desire in the American public not to ‘go it alone’ in Iraq or other conflicted areas of the world. Although George Bush never promised to consult others more often if he won the 2004 presidential election, the process of bringing more allies into the U.S. coalition in Iraq required considerable give-and-take negotiating at UN and NATO headquarters. The next U.S. Administration – whether it is led by a Democrat like Barack Obama or a Republican like John McCain – will be forced to take a more multilateral approach, eschewing the aggressive approach that came to describe George Bush’s eight years in office. In consulting with its NATO allies, and other middle powers and non-nuclear weapon states, there should be an increased opportunity to press for substantive change in U.S. and NATO nuclear doctrine.

There needs to be more debate among American citizens and among the United States’ allies about whether the new pre-emptive doctrine is a greater threat to the world’s security than, for example, the threat from small-scale tyrants like Iraq’s belated Saddam Hussein and North Korea’s Kim Jong-II. In any discussions about whether the U.S. itself now poses the most serious threat to world security, some facts need to be highlighted – after all, it is better to judge a nation by what it does, not what it says. The U.S. has yet to take its nuclear arsenal off the high alert status of the Cold War. As this article points out, it has not renounced first use and it continues to threaten to use nuclear weapons, if necessary, in any circumstance. It opposes ratification of the Comprehensive Test Ban Treaty and it unilaterally withdrew from the ABM Treaty. In addition, it has already made plans to shorten the time needed to resume testing of new and more usable tactical and battlefield nuclear weapons.

The situation is similar to a boy’s gang where the leaders are hell-bent on a dangerous course. Do the other boys follow them blindly or do they call a meeting to argue about the club’s rules and principles?

Being a member of the NATO club does not entail unquestioning allegiance to the United States’ leaders and their policies. In the run-up to the election, America’s allies must question whether the United States’ comparatively enormous stockpile of nuclear weapons remains necessary. Questions need to be asked as to whether the U.S. threat to resort to pre-emptive nuclear war, rather than rely on minimal deterrence, increases or decreases international security. To conclude, the leaders of the NATO Alliance need to make some significant moves to transform their reliance on nuclear doctrine because, if not, the most important non-proliferation treaty in history will fail to receive in 2010 the support it requires for building a more secure world.

References

2 Due to space constraints, this article does not overview the evolution of ‘new’ U.S. ‘pre-emptive’ or ‘preventive’ strategy toward or away from nuclear ‘first use.’ Nor does it provide evidence of the Bush Administration’s seemingly greater willingness to resort to nuclear use. Such discussions and policy debates date back prior to 2002 when excerpts from the U.S. Nuclear Posture Review were leaked to the New York Times and Los Angeles Post and subsequently posted by the Global Security Institute; www.globalsecurity.org/wmd/library/policy/dod/npr.htm.
3 Confidential interviews by the author with various NATO defense policy-makers at NATO Headquarters in Brussels and at a NATO-sponsored conference on Weapons of Mass Destruction (WMD) in Vilnius, Lithuania, including Dr. Guy Roberts, Director of the Nuclear Policy Directorate, Defence Policy and Planning Division, NATO Headquarters, April 23, 2007, and Dr. Michael Ruhle, Head, Speechwriting & Senior Policy Adviser, Policy Planning Unit, Private Office of the Secretary General, NATO Headquarters, April 24, 2007.


The *Alliance’s Strategic Concept*, op.cit., para. 63.

Confidential interviews by the author of Dr. Guy Roberts and Dr. Michael Ruhle, op.cit.


Interview by the author with Canada’s Deputy Ambassador to NATO, Robert McCrae, February 2001, and off-record comments by senior members of the US Delegation to NATO, February 2001.


Erika Simpson, *NPT Conference Collapses in Acrimony*, Embassy Canada’s Foreign Policy Newsweekly, June 1, 2005.

The presentations and final reports from all these meetings are providing more launching points for further discussion in 2008. See the Middle Powers Initiative website at www.middlepowers.org for background information. See also Canadian Pugwash Group, *Canadian Pugwash Group calls for NATO to denuclearize*, www.pugwashgroup.ca.

Erika Simpson, *NATO and the Bomb*, op.cit., for analyses by high-level decision-makers (e.g. U.S. Presidents, Canadian Prime Ministers, etc.) of how deterrence could fail due to misunderstanding, miscalculation, poor communication, irrational leadership, and accident.


Rumsfeld wanted Belgium to agree to repeal a law which gives its courts universal jurisdiction to try cases of genocide, war crimes and human rights violations. While Belgian parliamentarians did agree to change the law to cases in which either the victim or the accused were residents of Belgium, war crimes lawsuits were filed against U.S. President George Bush, Prime Minister Tony Blair, U.S. Secretary of State Colin Powell, General Tommy Franks, and Secretary of Defense Donald Rumsfeld. For more information, see *The Sunflower*, July 2003, No. 74; *New York Times*, 14 June 2003; Wall Street Journal, 13 June 2003.

As the deadline passed for governments to sign exemption agreements or face the suspension of U.S. military aid, President Bush issued waivers for 22 countries but he did not include six future NATO allies: Bulgaria, Estonia, Latvia, Lithuania, Slovakia, and Slovenia.


Over the past decade, Iran has made modest, steady, and gradual advances in its missile development. Iran appears to be pursuing advancement of its strategic missile capabilities “with incremental increases in range and payload technology.” Since the 1980s, Iran has been developing its capabilities through international cooperation, purchases, and indigenous development.

The U.S. National Intelligence Council in 2001 stated that Iran could develop an intercontinental ballistic missile (ICBM) capable of hitting targets in the United States by 2015. These estimates have been further endorsed by various other U.S. government agencies, which argue that “Iran could have long-range missiles capable of reaching the U.S. and much of Europe before 2015.” This argument is used to justify the proposed U.S. missile defense assets in Europe that would protect the U.S. and its allies against long-range ballistic missile threats. The proposed missile defense system would consist of radars and interceptors based in Czech Republic and Poland, respectively, deployed around 2012. However, this paper argues that Iran may not pose a significant missile threat to the United States and its allies by 2015 due to the following reasons:

- Iran still faces significant technical hurdles with regard to technologies such as staging, guidance systems, and aerodynamics.
- Indigenous development of an Iranian ICBM is not very likely and it would have to heavily rely upon international transfers and purchases.
- ICBM development requires rigorous testing under different conditions to ensure high reliability.

Given the current status of the Iran program, it is therefore quite unlikely that an ICBM could be fielded by the year 2015 without external assistance and a considerable amount of technology transfer from external sources, mostly from North Korea.

Only if these factors change, the pace of the Iranian missile program will also change.

Iran’s Missile Programs

Iran desired to acquire ballistic missiles during the Iran-Iraq war in the 1980s. At that time, Tehran found itself ill-prepared to retaliate against Baghdad’s missile attacks. Hence, in order to protect itself, it strove for self-reliance in missile technology and production.

Iran focused on importing and producing Scud-B (300 kilometer range) and Scud-C (600 kilometer range) missiles from North Korea, Libya, Syria, and China. Iran’s first Scud B’s were delivered by Libya in 1985. Subsequently, Iran also indigenously built and assembled Scuds.

From the early 1990s, Iran’s focus shifted towards the development of the intermediate range Shahab-3 and Shahab-4 missiles. Shahab-3 is a single-stage missile, weighing 16 metric tons, and is liquid fueled. Shahab-3 is based on North Korea’s NoDong missile. There were reportedly...
ten tests from 1998–2006. It has a range of 1,300 kilometers with a 750 kg payload. This range provides the missile with the capability to hit key targets in Saudi Arabia and Turkey as shown in Figure 1. This figure has been obtained by computer simulations based on publicly available technical data. The launch site chosen here is Emamshar on the eastern border of Iran. Shahab-3 is also capable of striking key targets in Israel if the missile is launched from sites in western Iran.

Although the Shahab-4 has been characterized by Iran as a space launch vehicle, it could be used as a technical base for intermediate- and intercontinental-range missiles. The Shahab-4 was originally thought to be based on Soviet R-12 (SS-4 Sandal) technology obtained from Russia. Later reports said that the Shahab-4 was based on the North Korean TaepoDong-I technology. The TaepoDong-I in turn is based on a NoDong-derived first stage and a Scud-derived second stage. The TaepoDong-I was first tested in August 1998 and neither North Korea nor Iran are known to have deployed this missile. The current status seems to be unclear, and it could well have been terminated according to some sources. Based on openly available technical data, the results of a computer simulation for Shahab-4 are presented in Figure 2. This figure shows that, if the missile was successfully developed, it would allow Iran to target Israel, Saudi Arabia, and Turkey from launch sites anywhere in Iran.

Another Iranian project is the one- to two-stage solid-fueled Ghadr series of missiles. Solid rocket motors possess several advantages over liquid rocket engines, which make them ideal for military applications. These advantages include their high density and low volume, nearly indefinite storage life, instant ignition without fuelling operations, and high reliability. The Ghadr missile also has a “baby bottle” style nose for extra aerodynamic efficiency. In May 2005, Iran announced at a parade that Ghadr had a range of 1,800 kilometers. This range is sufficient to put the U.S. bases in the Middle-East and Israel under threat. In September 2007, Iran paraded the Ghadr missile with a slogan from Ayatollah Ali Khamenei reading, “The Iranian nation is ready to bring any oppressive power to its knees.” However, it is difficult to conclude from open sources if this missile has a solid motor as claimed in May 2005.

Iran recently also announced that it had manufactured a new, solid-fueled missile named Ashoura. Ashoura reportedly has a range of approximately 2,000 kilometers. Iran is expected to flight test this missile in the near future. However, very little is known about other technical features of this missile.

Iran’s Space Program

Iran announced the creation of its national space program in 1998. Coincidentally, the announcement came on the heels of Iran’s first tests of the Shahab-3 missile. Some analysts speculate that Iran’s space program is now a cover for Iran’s development of longer-range missiles like the IRSL-X-2 and Shahab-6. Tehran claims these two rockets are exclusively for satellite launches, but as put by one expert, “a satellite launcher is basically a covert intercontinental missile.” Iran tested its first sub-orbital rocket in February 2007. The rocket reached an altitude of 150 kilometers before falling back to Earth and deploying a parachute for recovery. Iran claimed that the rocket was intended for research and is part of its goal of launching...
Iranian manufactured satellites on Iranian manufactured rockets. It is estimated that the rocket's operational range with the same payload against a ground target might be approximately 300 kilometers.

Iranian officials often discuss space and missile developments simultaneously, perhaps indicating the parallel nature of the programs. They have openly admitted that the Shahab missile system has been used as the basis for developing Iran's space launch vehicle (SLV).\(^1\) In fact, Nasser Maleki, Deputy Director of Aerospace Industries Organization (AIO), openly acknowledged that the technology used for building a space launch vehicle could also be used to manufacture missiles.\(^2\) Other reports suggest that Iran is trying to acquire an SLV based on North Korea's TaepoDong-2. However, North Korea's TaepoDong-2 only flight test failed in July 2006 and no further tests of this system have been reported since then.

Hence, as of 2007, Iran has only flight tested its NoDong variant Shahab-3, which has a range of 1,300 kilometers. Iran is keen on improving its solid fuel technology, possibly using the Ghadr and Ashoura missiles. Iran may also be disguising its ballistic missile program as a program to build space launch vehicles in order to confuse intentions, legitimize international purchases and avoid public scrutiny.

**External Assistance and Collaborations**

The current level of sophistication of the Iranian missile program and the speed of its development would not have been possible without extensive assistance from North Korea, Russia and China. Iran has received outside assistance for both its space and missile programs from Russia, and China,\(^3\) and has collaborated with North Korea on its missile program.\(^4\) Russia, China, and North Korea have helped the advancement of the Iranian missile program in the following ways:

- **Russia**: Russia has allegedly transferred guidance and propulsion systems and their components, high-strength steels and special alloys, as well as manufacturing and testing equipment. Specialists from two Russian defense firms are also known to have visited Iran, and Iranian students received training in missile technologies at Russian institutes.\(^5\) Russia has helped Iran with wind-tunnel testing of missile nose cones.\(^6\)

- **North Korea**: In November 1999, Iran imported twelve NoDong missile motors from North Korea. In 2001, Iran purchased missile airframes, rocket motors, and ballistic launchers from North Korea. And in 2002, Iran procured Scud engine clustering and stage-adding technology from North Korea.\(^7\) Payload spin up demonstrated by the TaepoDong-1's third stage solid propellant rocket motor appears in both Iran's Shahab-3 and Pakistan's Ghauri-2.\(^8\) In 2005, North Korea reportedly transferred NoDong-B missiles. On January 17, 2006, the flight test of NoDong-1 for North Korea was attended by members of the Iranian Revolutionary Guards Corp who also reportedly attended North Korea's July 12, 2006, TaepoDong-2 missile test.\(^9\) The North Koreans also helped Iran develop a series of missile test facilities located around the Shahroud region.\(^10\) The North Korean's helped Iran to develop a testing range and accompanying tracking system in Tabas.\(^11\)

- **China**: In 1987, Chinese engineers built a second missile production plant, located in Semnan. Also in 1987, China built Iran's Bandar Abbas facility, which is useful for testing, assembling, manufacturing, and upgrading of Chinese built cruise missiles.\(^12\) The level of sophistication of Iran's ballistic missile pro-

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**Figure 3**: North Korea's Ballistic Missile Program

- **North Korea's Ballistic Missile Program**
  - Development cooperation
  - Possible TD-2, Shahab-5/6 joint development
  - Missile and technology supply
    - No Dong/Brahui - Taepo Dong
  - Missile development cooperation
  - No Dong/Brahui
  - Taepo Dong

- **China**
  - DF-01 development tie-up in mid-1970s
  - DF-3 ICBM technology
  - Iran missile supply tie-up
    - Good, No Dong; TD-2 engine technology
  - Missile and technology supply
    - Good, No Dong; TD-2 engine technology
  - Development cooperation
  - Possible TD-2, Shahab-5/6 joint development
  - Missile and technology supply
    - In exchange for HEU technology, etc.

- **USSR**
  - Missile technology leaked (provided?)
  - SS-5 medium range missile design and main parts
  - No Dong engine technology (SS-5)
  - SLBM technology

- **UK**
  - 50 percent stake in AGO [UK's Dynamics]
  - Approved at time of Egypt's manufacture of Scud missiles
  - Additional Scud missiles supplied in the late 1970s

- **Egypt**
  - Missile development cooperation
  - No Dong technology supply

- **Libya, Syria, etc.**
  - Financing
  - Missile and technology supply

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program and the speed of its development would not have been possible without extensive assistance from abroad, notably from North Korea, Russia and China. While North Korea furnished the basic hardware for liquid-fueled rocket propulsion, Russia supplied materials, equipment, and training. China supplied help with guidance and solid-fueled rocket propulsion. Like India, North Korea, and Pakistan, Iran is not a signatory to the Missile Technology Control Regime (MTCR). While Iran’s missile program initially benefited from foreign technology, such technology transfer from MTCR members such as Russia or adherents such as China has been substantially curbed in recent years, although North Korean transfers may be continuing.26

Iran’s Indigenous Ballistic Missile

If Iran cannot obtain the Taepodong-2 or major subsystems from North Korea or other external partners such as Russia and China, it would have to build its intercontinental-range missiles independently. In order to do so, it would need a well developed infrastructure.

The Shahid Hemat Industrial Group (SHIG) is a key organization in the missile program. It is directly responsible for developing and producing the Shahab-3 missile. SHIG has hosted a number of Chinese and North Korean experts who have worked on Iran’s missile program.26

The Lavizan Technical and Engineering Complex is comprised of assembly facilities and metallurgy plants. According to GlobalSecurity.Org, in 1996, Sanam College (a Defence Industries Organization entity) and the Baltic State Technological University in Saint Petersburg, Russia, jointly developed the Persepolis research center to focus on the design of solid fuel rocket boosters.

In February 2003, Iran opened a solid fuel production facility, of which the location and details were not disclosed. According to then-Defense Minister Shamkhani, the solid fuel can be used for any kind of missile.27

These well-developed infrastructures could enable Iran to research, test and develop more powerful, intercontinental-range missiles. However, it is unclear when Iran could develop such missiles. Iran would have to perfect many critical technologies for producing an intercontinental ballistic missile and a delay in any one would delay the entire intercontinental-range program, according to some sources.26 Some of the key technologies to be perfected are:

- **Staging:** While many short-to-medium range rockets/missiles are single-staged, almost all intercontinental, long-range missiles (greater than 5,000 km) have multiple stages. In addition, optimization of the system must be developed.
- **Improving Accuracy:** The flight-tested Shahab-3 is believed to use an outdated Chinese navigation system with a circle error probability of 3,000 meters. However, there have been attempts to upgrade or replace this system.29 Longer-range missiles using this guidance system would be even less accurate since accuracy decreases with range. Most ballistic missiles employ inertial navigation systems (INS), which allow guidance without resorting to external sensing or measurement. During the boost phase, the missile makes flight corrections based on guidance system inputs to actuators (or other devices) controlling various thrust vectoring modalities. There are some reports that suggest that the Shahab-3 guidance systems have been enhanced with the addition of a Global Positioning System (GPS).30 Such a system would also more accurately establish the missile’s position at launch, thus potentially improving its circular error probability to 190 meters.31 However, many in the analytical community doubt the use of GPS guidance in Iranian missiles.
- **Improved Aerodynamics:** Rockets and missiles can have high catastrophic failure rates. One of the causes for failures is instability, which arises from the fact that the only control available is derived from vector thrust mechanisms such that the loss or major variance in thrust normally results in a destroyed vehicle. Limited stability is achievable through the addition of air foils when in atmospheric conditions and by spin stabilization (gyroscopic effect) when in space.

Iran currently possesses the second largest ballistic missile inventory in the developing world after the Democratic People’s Republic of Korea (probably several hundred Scud-type missiles and an estimated 100 NoDong type missiles, with that inventory still growing). It is currently capable of employing ballistic missiles and/or long-range artillery rockets against its regional neighbors, Israel, and Western forces deployed in the region. Iran’s ballistic missile development has steadily proceeded since the early 1990s. Given favorable conditions, some assessments are that Iran is on track to extend the range of its ballistic missile capabilities to cover Southern Europe, North Africa, and South Asia by 2012 and possibly the continental United States by 2015–2020.

However, these estimates are subject to change dependent upon a host of technical, international, and domestic factors that cannot be accurately predicted. This estimate is also supported by the Rumsfeld Commission report of 1998, which observed that “a nation with a well-developed, Scud-based ballistic missile infrastructure would be able to achieve first flight of a long-range missile, up to and including intercontinental range (greater than 5,500 kilometers), within about five years of deciding to do so.” One source notes that this estimate has been
true for some countries but not others, for example the Indian Agni-3 missile, an intermediate range ballistic missile. India began its pursuit of the Agni-3 in 2001. The missile was first tested unsuccessfully in 2006 and successfully in April 2007. On the other hand, Brazil is yet to successfully fly its 40-metric ton space launch vehicle, despite a decade of work.

Some Conclusions

As mentioned earlier, the level of sophistication of Iran's ballistic missile program and the speed of its development would not have been possible without extensive assistance from abroad, notably from North Korea, Russia, and China. Given the state of current infrastructure, Iran's technical capabilities, and favorable conditions, Iran could possibly test a medium-range missile in the near future, most likely within this decade. And a continental ballistic missile could still take longer without external assistance, mainly from North Korea. However, if North Korea successfully tests such a system and transfers it to Iran, it could considerably affect this estimate.

Assuming Iran decides to pursue its long-range option to deliver weapons of mass destruction indigenous-ly, it still must cross a number of technical hurdles such as flight stability and control, guidance, and stage separation systems. Furthermore, a challenge for Iran lies in reducing the risk of launch failure to as low as 2–5%. This is because there is a tremendous amount of cost involved in developing long-range systems. Hence, the risk of launch failure has to be as small as possible in order to make sure that these systems are effective and serve the purpose for which they are developed. This would mean testing missiles again and again, under different and difficult conditions, to ensure high reliability. This would considerably delay the Iranian missile program thus making the estimate of 2015 a very optimistic one. In sum, it could be concluded that Iran would have to rely heavily upon external transfers and assistance to pose any significant threat to the United States in terms of a reliable delivery of weapons of mass destruction by 2015.

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16 Iran's Ambitions for Simulating Ballistic Missiles Could Possibly Test a Medium-Range Missile in the Near Future, Most Likely Within This Decade.
... I have read that the Czech government started to negotiate with the US government about a possible US antimissile installation during 2001. I was then a Foreign Minister and a Deputy Prime Minister in charge of foreign policy and security matters and I can assure you that not only I did not take part in any such negotiations, I was not even informed that they took place. Consequently I cannot confirm their existence.

In June 2002 there was a parliamentary election in the Czech Republic. No political party went into that election campaign, or even into the subsequent elections in June 2006, with the proposal to approve the installation of a US military base. So the people were never asked whether they want the US base or not. In September 2002, however, the then Social Democratic Minister of Defence in the new coalition government announced that he is involved in “technical discussions” with the US about a possible US missile defence base in the Czech Republic. At the same time he confirmed that no political decision was taken by the government, let alone by the Parliament. A few hours after the new right-wing government was finally installed in January 2007, it received a formal US request to install a radar station in the Czech Republic as part of the anti-missile system which would also include 10 interceptors in Poland.

The Czech government then hired a public relations consultant to run an explanatory campaign in order to persuade the people that the US military base is necessary and that the radar will protect both the US and the Czech Republic from a possible missile attack from rogue states such as North Korea and Iran. Some time later, North Korea was quietly dropped.
The campaign cost lots of money and received huge publicity but it was short on concrete arguments. From the beginning its major shortcoming was an absence of an explanation why Iran is such a threat both to the United States and to the Czech Republic. It is acknowledged that Iran does not possess long-range missiles capable of hitting the US, but it was argued that it may be able to produce them in 10-15 years and thus the world has to be prepared. As the late Wolfgang Panofsky pointed out in September 2007, “a ballistic missile has its return address written on its trajectory; such a launch would risk annihilation of the country and its leadership through retaliation by the USA.” There are suicidal bombers but no suicidal countries. Both Panofsky and Noam Chomsky stressed that for a terrorist group, and a country supporting it, it should be far easier to deliver a nuclear weapon by trucks, aircraft, commercial shipping and similar clandestine means than by ballistic missiles. I am no expert but this makes sense to me. I am aware of the danger of comparing incomparable things but I still recall that during the very tough and repressive regime in the former Czechoslovakia with its closely guarded borders I was able to smuggle into the country many tons of literature and technical equipment.

We have never been given any explanation why Iran would want to target the Czech Republic or for that matter Poland, that is if we didn’t attract their attention by having a US military base on our territories. I noted Chomsky’s remark that “even if Iran had nuclear weapons and long-range missiles, the chances of its using them to attack Europe are lower than the chances of Europe being hit by an asteroid.”

The hard core of the arguments used by the supporters of the radar could be described as a kind of an emotional blackmail. Newspapers trumpeted bombastic headlines such as “Not to participate in the defence is a cowardice.” Another paper wrote about “a base in a country of chicken and yellow-bellies”. Many journalists resorted to comparing uncomparable things but I still recall that during the very tough and repressive regime in the former Czechoslovakia with its closely guarded borders I was able to smuggle into the country many tons of literature and technical equipment.

It has been argued that the radar station will enhance our own security but it was never explained how this will happen. Maybe the best explanation was given by Alexander Vondra, Deputy Prime Minister and former Ambassador to the United States, when he told the Heritage Foundation that “For us in the Czech Republic, which lies between Germany and Russia, an installation with a certain number of US troops would be good.” Similarly, Prime Minister Topolánek informed his party congress that “We must not allow our country again to fall into the totalitarian regime, including himself. Everyone is allowed to change his mind but it is sad to see a friend, who to such an extent lost his memory and common sense. Havel the President denies Havel the dissident. It is significant that the opponents of the radar receive support from those Western organizations, especially in the United States, who helped us to organize protests against the Soviet occupation.

I heard the Munich argument from President George W. Bush in September 2002 when he asked me – as the President of the UN General Assembly – to get the United Nations to support his war against Iraq. He supported his argument by reminding me – as a Czech politician – of Munich and the dangers of appeasement when he compared Saddam Hussein to Hitler. I am sure that he would not understand why people in Prague today compare Munich 1938 to the 2008 US recognition of the breakaway state of Kosovo and as appeasers they perceive those who are cowed by US pressure on us to agree to the radar station.

It has been argued that the radar station will enhance our own security but it was never explained how this will happen. Maybe the best explanation was given by Alexander Vondra, Deputy Prime Minister and former Ambassador to the United States, when he told the Heritage Foundation that “For us in the Czech Republic, which lies between Germany and Russia, an installation with a certain number of US troops would be good.” Similarly, Prime Minister Topolánek informed his party congress that “We must not allow our country again to fall into the geopolitical sphere of Russia. This is the real reason why the US radar base must be built in this country.”

On the other hand, even Czech top army officers acknowledge that the radar will be the eyes of the missiles in Poland and it would be understandable that the enemy would wish to blind them as soon as possible either by an anti-radar missile or by using some suicidal commandos. It has not been spelt out how the US plans to protect this radar station. The Poles obviously believe that they have to rely on their own protection and therefore they are demanding to strengthen their own air defence with
US Patriot PAC-3 systems and maybe also the tactical THAAD anti-missile system. For many Poles it is obvious that these weapons should defend them from any Russian threat. I have yet to meet a Pole who believes in any threat from Iran. The Czechs are more modest. To date, they apparently asked for access of Czech firms to US military contracts. As far as I know, so far they have been offered some really insignificant orders, including a cleaning job at a base.

The other argument in favour of the bases stresses that the system will also defend most of Europe with the exception of the south-eastern regions. This, of course, raises the question why we should not wait for a system which would be able to defend the whole of Europe and be an integral part of NATO’s European defence operations. I am, of course, aware of NATO’s last summer’s supplementary resolution on the need to come up with a plan to cover those European fringes not covered by the US system. If NATO would embrace the Czech and Polish bases and if bilateral agreements with the US would be substituted by an agreement with all NATO member states then, at least, some of our political parties, for example the Greens, would drop their current objections or misgivings. The system would then become more acceptable to some of the opposition social democratic Members of Parliament. The government is clearly aware of this fact and, therefore, looks with some hopes to next week’s Bucurest NATO summit. I assume that NATO will welcome the US contribution and might promise to incorporate it in their own future system. However, as no such system exists, and I am aware of the Canadian or Norwegian objections to it, the future of the Czech and Polish bases might depend on the interpretation of what is a general and vague promise on the part of NATO. And, of course, it will also depend on the decisions of the next US Administration, including on its willingness to finance such a system.

I remember the first Alliance meeting I took part in as a Foreign Minister. It was in April 1999 and foreign ministers of NATO member countries discussed not only the bombardment of former Yugoslavia but then US Secretary of State Colin Powell raised there the issue of the US anti-missile umbrella and the need for Europeans to support it. The British Foreign Minister Robin Cook responded quite passionately and warned fellow Europeans not to have anything to do with this dangerous form of “star wars.” I do not recall any explicit support for the US then. I am, of course, aware that the situation today is different. However, there are still skeptical voices heard from several NATO countries. They point to the ever increasing estimates of the cost of the entire system and also to the unconvincing results of the tests carried out to date.

This unreliability was recently stressed in Prague by former US Assistant Secretary of Defence, Dr Philip Coyle, who repeated over and over again that the anti-ballistic missile system is not effective under real operating conditions. The tests were carried out without decoys or other means of deceptive tactics to defeat the ABM system and with information which would normally not be available such as the test missile trajectories. Even under such unreal advantageous conditions six tests out of 13 failed, according to Dr Coyle, who also informed us that even close US allies such as Canada refused to participate in the anti-ballistic missile defence because they believe that it is not effective and they fear that it would cause instability in the system of international relations.

It was interesting to compare the observations of Dr Coyle with the assertions of Lt. General Obering. Dr Coyle believes that, given the speed of the current tests, it will take 50 years to complete all system tests. General Obering, Director of the Missile Defence Agency, who visited Prague several times (last time with a number of representatives of US arms companies), on the other hand believes that the anti-ballistic missiles will be in their Polish silos by 2013 and a radar will be moved from the Marshall islands to the Czech Republic in 2011. Listening carefully to both experts, it became clear that the system is not yet ready and it will require a great amount of further tests and improvements before the envisioned 10 missiles could be deployed in 2013. It therefore raises the suspicion that the bases in the Czech Republic and Poland will be a kind of guinea pigs providing the greatest joy to firms such as Raytheon, Lockheed, and many others. After all, failure of the current system and the subsequent need for further development improvements means a permanent commercial success.

I understand that the US Congress agreed to reinstate the monies allocated to the bases which have been cut from the relevant budget only after the US signs the agreements with the governments of the Czech Republic and Poland and at least 45 days after Congress receives a study that would independently evaluate existing alternatives to the anti-ballistic missile defence in Europe. The Polish government is in no hurry, though some members of the government hope to reach an agreement before the end of the year, i.e. before the departure of the Bush Administration. They believe that given the desire of the US government to complete the negotiations before the new Administration takes over the reins of power, they may be able to negotiate a better deal with the departing politicians. Others look forward to a new President and also hope that in the meantime the Americans will be able to pacify or at least to reduce the Russian anger and hostility towards the new bases so close to the Russian border.
On the other hand the Czech government is attempting to accelerate the negotiations and some hope that it may be able to sign a deal on May 5, 2008, when Secretary of State Condoleezza Rice is expected in Prague.

What is clear is that a majority of both Czech and Polish citizens oppose the establishment of foreign military bases on their soil. In the Czech Republic, frequent opinion polls indicate that 70% of the people have been unmoved by the government’s propaganda. Besides the arguments already mentioned many people and peace groups such as “No to Bases” mention several others:

- The Czech Republic could become a target of a first strike without being at war.
- It will become co-responsible for US conduct of preventive wars, which the US is prepared to carry out whenever it feels that its interests are endangered.
- The decision to use the base will remain entirely in the US hands, the Czech Republic will only be informed afterwards.
- There will be an increased danger of terrorist attacks in the Czech Republic and against Czech citizens abroad.
- Falling pieces of destroyed missiles will represent a danger to the population in the given region which maybe twice as large as the entire Czech Republic.
- The government report about the possible impact on health of people in the region and on the environment is perceived by leading Czech scientists as woefully inadequate and misleading.

Legally, the installation will lead to the violation of NATO’s undertaking of 1997 that there will be no foreign military bases in any of the new NATO member states. Equally, the installation will be a violation of the European Union document A Secure Europe in a Better World of December 2003.

By agreeing to the radar base, the Czech Republic will contribute to the rise of distrust between great powers, and between allies, including within NATO.

It is doubtful that the base will bring more technological know-how to the Czech Republic, as was promised in the past, for example in the case of major investments into the tractor factory Zetor, the aircraft factory Aero Vodochody, the nuclear power station Temelin. Compensation for export losses incurred when we agreed to ban all (non-military) exports to the Iranian Busher power station, etc. Those promises remained unfulfilled.

The Czech Constitution does not presuppose the establishment of any foreign military bases, only a short term stationing of foreign troops with parliamentary approval. The Constitution would, therefore, have to be changed (which cannot take place in the current political situation) or ignored with all the consequences.

As noone in the Czech Republic or Poland really believes that we may be threatened by Iran now or in the future, some hope that in combination with additional US commitments the bases will constitute a sufficient deterrent to Russia; others fear that the bases will unnecessarily provoke the Russian bear and make us vulnerable to any retaliation the Russians might consider adequate. President Putin’s Munich speech of February 2007 evoked the possibility of a new and dangerous “nuclear arms race.” I was not surprised when President Putin evoked the 1962 Cuban Crisis when Soviet missiles were similarly close to US homeland and the world was on a verge of a major war. Putin backpedaled soon, but the image remained. It seems to me that the Americans seriously underestimated the Russian sensitivity to US bases in Eastern Europe, so close to their homeland. The potential of this crisis to get worse and to lead to a new kind of a Cold War should not be dismissed lightly despite the recent talks between the top representatives of the United States and Russia.

I can understand that the recent offer made by US Secretary of Defense Robert Gates – that the Czech radar will not monitor Russian territory and the anti-missile defence in Poland will only be activated when the threat from Iran or from anywhere else is real, even coupled with a slowdown of the enlargement of NATO to include countries such as Georgia – is welcomed by Russia and also by Europe. All possibilities to reduce the tensions and reach an agreement should be explored despite the fact that any such promises can easily be broken again in the future – as happened in the past.

At the same time when the White House was still attempting to persuade the world of the dangers posed by Iran, one of the then Presidential Candidates, Fred Thompson, let the cat out of the bag by talking about the need for the anti-missile defence system to safeguard us from the potential threats posed by the strategic competitors Russia and China. This makes more sense than waiting for an Iranian attack that would never come, and terrorists who use bombs cannot be shot at with anti-ballistic missiles. This competition is obvious, such as the desire of the United States to control most of the world’s strategic raw materials, especially oil. The crucial question is what forms this will take and which methods will be resorted to.

Ten interceptors in Poland will obviously not represent a serious threat to Russia. However several military experts do not exclude the possibility of a future enlargement of such bases and more advanced missile defence. These experts seem to agree with peace groups that the main purpose of the bases is to negate the deterrent role that states expect from nuclear weapons and thus open space for the USA to carry out military actions anywhere
which they could not afford to do if there were a credible threat of nuclear retaliation. The ability to blunt a retaliatory attack by an opponent possessing nuclear weapons will significantly increase the power of the Unites States. Zbigniew Brzezinski writes about “the desire to extend US supremacy as far as possible into the future before it would have to be inevitably replaced by a multilateral system.”

After 9/11, European countries offered to regard this attack as a violation of Article 5 of the North Atlantic Treaty and thus as an attack against all members. Washington rejected an offer to help which some perceived as “European trap” to enable Europe to influence the conduct in the conflict. The United States preferred the “Coalition of the Willing” that was prepared to support a de facto unilateral military action of the United States. For similar reasons the United States would prefer to build the European missile shield as part of bilateral treaties with “willing” Czech Republic and Poland. This dangerous unilateral policy that may pave the way to more wars, including even ones where tactical nuclear weapons may be used, has to be strongly resisted. The Czech government, fully aware that over 70% of its citizens oppose the base, will not allow a referendum on the issue. The Parliament’s backbone may be strengthened if the opposition parties and Czech (and Polish) civil society peace groups receive full solidarity backing from at least some European governments and from non-governmental organizations worldwide, especially from the USA. I was glad to note that some such support from the US has been already forthcoming, including from groups who used to support our human rights groups before 1989, including then Vaclav Havel.

This presentation was given at the Article VI Forum meeting “NPT: Pathfinder to a Nuclear Weapons-Free World”, held by the Middle Powers Initiative in Dublin/Ireland on March 28–29, 2008. The meeting was co-sponsored by the Government of Ireland.

JAN KAVAN served as Czech Republic’s Deputy Prime Minister for Foreign and Security Policy from 1999 to 2002 and as Minister of Foreign Affairs from 1998 to 2002, and has most recently served as a Deputy in the Czech Parliament; kavanjm@seznam.cz.

US Missile Defense Plans in Europe
Implications for Russia and Europe

JÜRGEN ALTMANN AND GÖTZ NEUNECK

The US government under President George W. Bush plans to build ballistic missile defense (BMD) systems in Eastern Europe as part of the intended Global Ballistic Missile Defense System (GMD/GMDS). The US is negotiating arrangements with two host countries to base an interceptor site in Poland and a fixed mid-course radar in the Czech Republic. At a later time, a mobile radar is to be located closer to the Middle East region. These plans are causing a renewed controversy in Europe about the necessity, rationale, and implications of such a system.

The stated purpose of the “ground-based mid-course defense system” is to help to defend US forces stationed in Europe, US friends, and allies as well as US territory against long-range missile threats, mainly from Iran. According to the Director of the Missile Defense Agency (MDA), the US chose these geographical locations in order to maximize the coverage of Europe for ballistic missile launches from the Middle East and redundant coverage for the US against intercontinental ballistic missiles (ICBMs).

Over the coming years it is planned to deploy 54 ground-based interceptors (GBI) at three locations in the US (Vandenberg/California and Fort Greely/Alaska) and Europe. Once the production capability of the GBI is established and more locations are ready for deployment,
this infrastructure can be expanded rapidly. The administration fielded the first GBIs in the US in 2002 and maintains that it has since then achieved an “operational capability” or “a rudimentary protection” of the continental United States.

In the next years it is planned to deploy up to 44 GBIs to the US. Further GMDS elements are a sea-based X-Band-Radar, upgraded early-warning radars, mobile sea-based and forward-based radars, a Space Tracking and Surveillance System (STSS), other lower-tier missile defense systems, and a Command, Control, Battle Management, and Communication Network.

The reactions in Europe are quite controversial: some governments, especially in Poland and the Czech Republic, hope that the two BMD sites would strengthen their ties with the US and could become a decisive security guarantee against Russia. The supporters claim that the GMD sites would protect Europe as well as the US. However, for geographical and technical reasons, the GMD sites cannot protect the countries close to Iran such as Turkey, East-Bulgaria etc. – these countries would have to be “protected” by additional NATO missile defense systems.

Meanwhile, more than 60 percent of the public in Poland and Czech Republic oppose the BMD bases fearing that their countries might become targets of missile attacks in the future. European opponents argue that the technology is premature, that no Iranian ballistic missile threat to Europe exists, and that the unilateral participation of Poland and the Czech Republic would harm efforts for a common European Defence and Security Policy.

President Putin strongly criticized the US missile defense plans in Europe as “muscle-flexing,” arguing at the Security Conference in Munich in February 2007 that this would lead to “an inevitable arms race.” Russian politicians voiced their main concerns: Foreign Minister S. Lavrov said that “Any unilateral anti–missile projects would fundamentally alter the continent’s strategic relationship.” Lavrov also said: “We must acknowledge that these objects are fully suitable to intercept missiles fired from Russian territory.” The President puts into question the whole arms-control architecture which helped to end the Cold War due to a changed “strategic balance in Europe.” On December 12, 2007, Russia suspended adherence to the 1990 Conventional Forces in Europe (CFE) Treaty, which imposes limits on the deployment of tanks and other military equipment in Europe. This erosion of arms limitation can also affect other agreements such as the Open Skies Treaty or the Intermediate-range Nuclear Forces (INF) Treaty. At the same time, President Putin ordered the military to place the strategic forces on a higher alert level. Russia has already resumed its long-distance strategic bomber patrols. The military threatened the possible deployment of nuclear short– or medium–range ballistic missiles (MRBMs) in the Russian exclave of Kaliningrad. A breeze of Cold War is in the air again, and if both parties don’t find ways to handle the problem a new block confrontation could emerge. There are many reasons for these strong and bad reactions by the Russian government: the growing unease with Western interference in Russia’s backyard; the deployment of US troops in former Warsaw Pact countries; and the US BMD plans near to the Russian territory. President Putin said: “In violation of previous agreements, certain member countries of the NATO alliance are increasing their resources next to our borders.”

On the other hand, President Putin has also offered co-operation to the USA by joint use of a Russian early warning radar in Azerbaijan and he proposed deployment of interceptors in south–east Europe or Turkey. Unfortunately, US Defense Secretary R. Gates has stated that the Azerbaijan Radar would only be regarded as “an additional capability” to complement the proposed GMD sites in Europe. The ongoing US-Russian talks on missile defense cooperation have not yet led to any result.

The European and in particular the German political debate is mainly political ignoring many important physical, geographical, and technical facts. Most of the papers from think tanks and newspapers focus on the future strategic relationship between the US, Russia, and Europe or on supposed domestic interests such as influencing elections. High-ranking US politicians tried to downplay the threat for Russia posed by additional BMD sites in Europe. Secretary of State Condozezza Rice maintains that the interceptors are far too few to upset the Russian-US relationship. There are also technical arguments presented by US envoys which try to challenge Lavrov’s statement. General H.A. Obering and P. Sanders of the US MDA have come forward with explicit statements that the Poland–based interceptors could not target Russian ICBMs, arguing with missile and interceptor velocities and times. These statements are more than dubious.

Some Facts About the Iranian Ballistic Missile Threat

US President G.W. Bush says that there is a “real and urgent” need for missile defense in Europe. According to the US intelligence community, Iran has an aggressive ballistic missile program and the US government believes that Iran develops nuclear weapons. The international community became suspicious about the nuclear program when it learnt about covert fuel–cycle facilities and acquisition activities. Worldwide pressure and sanctions were
instituted; it is estimated that Iran, if it intends to build a bomb, would need 5 to 10 years. Tehran procured several Russian-originated Scud-B missiles from Libya and Syria, later known as Shahab-1. Iran also started to assemble Scud components from North Korea and began production of liquid and solid-propellants. But Iran was not very successful in “reverse-engineering” Scud-B. Hence, since 1991 it also acquired the Soviet 580 km Scud-C (Shahab-2) from North Korea.10

After the Iraq–Iran war (1980–1988), Iran purchased NoDong missiles (Shahab-3, range around 1,100 km) from North Korea.11 There seems to be no indigenous manufacturing capability in Iran. Until early 2006 there were ten Shahab-3 test launches reported, not all of which were successful.12 The Iranian government claims that the Shahab-3 is an indigenous activity and that missiles have been deployed since 2003. However, there is evidence that the development has not been completed. Iran seems to depend on Russian and North Korean networks; it has only a small number of Shahab-3 missiles, which are not very reliable, and given their limited range cannot reach Central Europe. There are speculations about more advanced versions of the Shahab-3, dubbed Shahab-4 and 5, but a complete new missile has not yet been detected.

A number of intelligence services believe that Iran is also developing new longer-range ballistic missiles. At present, Iran has no Shahab series production, and development of new engines or guidance components is beyond Iran’s capabilities. Specialists conclude that the status of Iran is comparable with the situation of Iraq in the 1980s or 1990s.

Another way to acquire an MRBM capability is to acquire tested North Korean TaepoDong (TD) technology (TD-1, range 2,300 km; TD-2, range 5,500 km). In the only three-staged space launch vehicle test in August 1998, the TD-1 failed. In July 2006, North Korea tested a missile widely assumed to be the TD-2 that was a complete failure. The US Central Intelligence Agency (CIA) maintains that the TD-2 can fly 10,000 km which is very doubtful given the current state of missile technology in North Korea. A missile with such a range must be much larger in terms of missile diameter and rocket engine. One can conclude that neither Iran nor North Korea have the capability to reach the US. Iran is not capable of producing its currently deployed guided missiles indigenously. There are no indications that Iran is working on a long-range missile which can be equipped with a nuclear warhead and which can target, e.g., Central Europe. The vague possibility that this could happen gives some more time to find a solution with Iran.

US BMD Plans in Europe and Rationales

The ten interceptors in Poland are to be silo-based on a field the size of a football pitch. They are a two-stage variant of the originally three-staged interceptors that have already been deployed in the US. The US State Department claims that no test will be conducted in Europe. But even for no more than ten missiles in Poland a new, substantial, and costly test program would have to be set up. It is therefore rather likely that other locations in Europe might be added.

The European Midcourse Radar (EMR), proposed to be deployed in the Czech Republic, is a high-resolution tracking radar which is to identify and distinguish the warhead from the missile parts and to guide the GBIs to the target.12 The radar capability is limited by the number of transmit/receive modules (T/R) which are distributed across its 100–120 square meter antenna.13 At the current stage of planning, the EMR can track only a few objects in flight. The maximum number of T/R modules is 300,000, which would increase the tracking capacity of the radar to hundreds of objects tracked. If the US decides to expand the capability of the EMR, this could compromise the Russian deterrent.

The third element of the European Missile Defense is a transportable forward-deployed X-band radar (FBX). The air-transportable FBX can be deployed closer to the hypothetical Iranian threat and in principle it provides earlier acquisition and more tracking data. The US Administration sees it only as a tool to augment coverage and interception of adversial short- to mid-range missiles.

A debated issue is the current performance and future capability of the exo-atmospheric “hit-to-kill” technology employed in the mid-course phase, when a kill vehicle is to collide with a target (warhead) previously released by an attacking missile. There have been relatively few tests of the deployed GMD system since 2002. In September 2007, the MDA conducted the seventh successful of a total of twelve attempted intercepts.14

So far, the test conditions have remained rather unrealistic. The targets are cooperative and not comparable with targets in a real attack situation. It is striking that in later tests new malfunctions occurred which had not been observed before. Certainly such a complex technology will improve over time, but it is clear that the current system cannot cope with countermeasures. Lightweight decoys, e.g. warhead replica balloons made of aluminized mylar, can be included in the payload and set free with the real warhead after burnout of the ballistic missile in space. Due to the missing drag force outside the earth’s atmosphere, these objects travel along with
the heavier warhead during the long mid-course phase before re-entry. The GMD system would have the complicated task to select the “right” target. A key problem is that none of the physical observables that could be used to distinguish decoys from warheads can be identified with infra-red and radar sensors. For example, the system cannot look into inflated and metal–coated balloons and therefore cannot discriminate the real warhead from the decoys.

Another open question is whether the US Congress will fund a third GMD site in Europe, while it is not clear that the GMD system even works for the protection of the US. Until now, Congress has cut funding for the European component in 2008. The House has reduced the MDAs budget request for the GMD system by $160 million and the Senate by $85 million. The Bush administration had requested $310.4 million.

If Iran were to develop ICBMs with nuclear warheads for attacking the USA, these missiles would have to have a range of 10,000 to 12,000 km. Due to the curvature of the Earth, such missiles would rise into the viewing cone of a radar in the Czech Republic about five minutes after launch, at about 2,000 km distance. From this possibility of trajectory determination the flight time to somewhere above East Europe would be about six minutes. When overflying East Europe, these ICBMs would be at about 1,000 km altitude. Interceptors in Poland would need around three minutes to reach this altitude in vertical climb and around four minutes if 1,000 km horizontal distance would have to be covered at the same time. Thus, the interceptors have to be launched within a few minutes after radar detection.

**Capabilities of the Planned BMD Systems Versus Russian ICBMs**

A radar deployed in the Czech Republic is much closer to missile silos in western Russia than to Iran. Thus, these Russian missiles would rise into the radar field of view much earlier in their trajectories. They could be detected about three minutes after launch and their flight could observed about ten minutes. This includes the time when the missile bus maneuvers in order to place re–entry vehicles on their respective trajectory. The radar in particular could observe the release and deployment of decoys. This provides valuable information for discrimination between warhead(s) and decoys. Whereas it is improbable that reliable recognition and identification will be possible in case of many objects – at e.g. 1,000 km, the radar beam from the EMR will be several km wide – a Russian planner will have to take a conservative approach and assume a significant discrimination capability.

The least consequence would be the use of more sophisticated decoys, but increasing the numbers of missiles and warheads is also likely countermeasure. The EMR is to be integrated into the global BMD system, thus the information gained (some discrimination, trajectories) will be relayed and could also be used for launch and control of US–based interceptors that have considerably more time to intercept the target than the ones from Poland.

Given that the Czech–based radar can observe Russian ICBMs, the next question is whether Poland–based interceptors can hit such ICBMs. To this question the Director of the Missile Defense Agency has explicitly stated: “U.S. System Cannot Counter Russian Offensive Missiles” and “European interceptor site has no capability to defend U.S. from Russian launches.”15 His viewgraphs show very fast Russian ICBMs and slow US interceptors. Ted Postol from the Massachusetts Institute of Technology (MIT), a long–time independent technical expert on BMD issues, analyzed the MDA assumptions. As Figure 1 demonstrates, the MDA Director uses slow ICBM speeds and an unnecessarily long interceptor launch delay. If these values are corrected, it turns out that an intercept from Poland is kinematically possible even for the northernmost European ICBM site. In a modified slide of June 2007, the ICBM speed was increased, but the interceptor speed still underestimated by one third.16

While it is true that ten interceptors based in Poland are no danger for the Russian nuclear force of about 500 ICBMs, the USA plans for continued expansion. Presidential National Security Directive 23 (PNSD–23), signed December 6, 2002, reaffirmed the policy of the Bush Administration “to develop and deploy, at the earliest possible date, ballistic missile defenses drawing on the best technologies available.” Deployment from 2004 on would serve “as a starting point for fielding improved and expanded missile defenses later.”17 Thus, Russia may be justified in viewing the deployments that are discussed at present only as the beginning of a much larger and more capable BMD deployment.

Another aspect, rarely considered, is the potentially offensive use of silo–based missiles in Poland: hypothetical ICBMs aimed from Iran to the mid– and western USA would fly over Belarus and Russia, respectively. To hit them in space, the interceptors would have to fly towards the east, that is towards Russia. With around 15 m length and 1.3 m diameter, the interceptor missiles are rather similar to medium–sized or small ICBMs. For example, the US Minuteman III with three nuclear warheads is 18 m long and 2 m wide. At least at the height of a crisis it is conceivable that a launch towards Russia would increase tensions.
Regardless of the political ramifications, the Russian proposals for joint use of an early warning radar in Azerbaijan (Gabala) or southern Russia (Armavir) with interceptors deployment in south–east Europe or Turkey make sense from a technical point of view. A radar station south of the Caucasus mountains would be blocked from seeing Russian ICBMs. Slower interceptors deployed at further away could in fact not hit such ICBMs in time. From a purely military–strategic viewpoint the Russian statements about the need for countermeasures and for targeting additional European sites also make sense.

Some Conclusions

A technical assessment shows that the planned radar in the Czech Republic and interceptors in Poland would provide substantial capabilities against Russian ICBMs in their western silos. Due to its integration in a global BMD system, the radar is more relevant than the interceptor site. The interceptors would grow in importance with increasing numbers – in Europe as well as in the USA. A Russian strategic planner will take into account a considerable future growth of the overall anti-missile system which would be seen as particularly threatening to the Russian second–strike capability in times when Russian arsenals would continue to shrink.19

Much of the Iranian ballistic missile technology goes back to early Russian origins, with detours via e.g. North Korea. If from its better knowledge of the Iranian capacities Russia feels that Iran may be incapable of building an ICBM, then it has all the more reason to fear that US plans are directed predominantly against Russia.

Thus, the deployment is not just a bilateral issue between the USA and the Czech Republic and Poland, respectively. Nuclear strategic issues are at stake with ramifications for Europe and the whole world, in particular for any discussion of future disarmament. Not only would further nuclear reductions become more and more difficult, but there is the outlook of a new nuclear arms race in terms of new missiles, warheads, penetrations aids, and ballistic missile defenses. This holds despite the fact that decoys, which are much less difficult to build than long–range missiles, will continue to frustrate any attempt to make oneself secure from nuclear attack, even by a much smaller power.

The Russian proposals of joint use of an early warning radar much closer to Iran makes technical sense; the same holds for the concept of deploying interceptors only after observation of Iranian long–range ballistic missile tests and deploying them closer to Iran as well. An appropriate alternative is deployment of sea–based Aegis cruisers in the Mediterranean and the Baltic sea instead of the more strategic land-based GMD System components in Poland and Czech republic. The joint use of a radar, on the other hand, would require a very high degree of co–operation. How the USA will deal with such proposals for co–operation can be used as a litmus test on whether it takes Russian concerns seriously and makes attempts to allay these fears. There is still enough time to work out reliable solutions for a potential Iranian threat if this really emerges.

Europe should play an important role in bridging the Russian and the US interests. On the other hand, if Europe as a whole fails to do so, it might find itself again between the fronts of two nuclear powers.

It goes without saying that the best solution would be to prevent Iranian ICBMs and nuclear weapons by international agreement – achieving this will probably need a return to the obligations towards nuclear disarmament by the declared nuclear–weapon states under the Non–Proliferation Treaty. Wolfgang Panofsky, the highly respected Stanford physicist, who served as presidential advisor for several US administrations and who died on September 24, 2007, at an age of 88, said in a speech in
2004: “Since a single nuclear weapon can kill on the order of one million people when detonated in a metropolitan area, an active defense must achieve almost 100% intercept to be effective (…). But reducing the role of nuclear weapons to the single function of deterring their use is a necessity if their spread across the globe is to be inhibited, if the other nuclear dangers are to be contained, and if the damage which nuclear weapons can cause is to be minimized.”

References
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5 Putin Warns NATO against border build-up, AFP November 20, 2007.
7 US Says Russia Offer Cannot Replace Missile Shield, Reuters, June 14, 2007.
10 With a 700 kg payload and an estimated range of 1.300 km, it can reach targets in Israel.
11 The first flight test was conducted in September 1998.
13 Currently roughly 20,000 T/R modules are planned. See Lewis and Postol, op.cit., p. 14.
15 H.A. Obering, Missile Defense For U.S. Allies And Friends, op.cit., viewgraph 21. The additional assertion “No plan to expand the number of interceptors in Europe – not in our five year budget” may not be very assuring to Russia.
16 From map distances and times given, an ICBM speed of 5.8 km/s and an interceptor speed of 5.4 km was assumed; however the latter reaches speeds between 7.7 and 8.3 km/s; explicitly stated was the interceptor launch delay of 250–300 s after ICBM launch. Obering presentation of 13 June 2007, viewgraph 27, with analysis in T.A. Postol and G.N. Lewis, The Proposed US Missile Defense in Europe: Technological Issues Relevant to Policy, Presentation at American Association for the Advancement of Science, Washington, DC, August 28, 2007; see also Lewis and Postol, The Technological Basis of Russian Concerns, op.cit.
18 Postol and Lewis, op.cit., viewgraph 24. We want to thank Ted Postol for the permission to use his viewgraph.

This article is a shorter version of the paper “US Missile Defence Plans in Europe – Implications for Russia” written for the 57th Pugwash Annual Conference in Bari/Italy, 21–26 October 2007.

JüRGEN ALTMANN is a physicist and peace researcher at Universität Dortmund, Germany, and has studied scientific-technical problems of disarmament since 1985; altmann@ep3.ruhr-uni-bochum.de.

GÖTZ NEUNECK is Research Advisor and Head of IFAR², the Interdisciplinary Research Group on Disarmament, Arms Control and Risk Technologies at the University of Hamburg; he is also German Pugwash representative; neuneck@uni-hamburg.de.
Fix the Proposal for Nuclear Cooperation with India

ABOLITION 2000 US-INDIA DEAL WORKING GROUP

On 5 May 2007, at Abolition 2000’s Annual General Meeting held in Vienna during the Preparatory Committee meeting for the next review of the Non-Proliferation Treaty, the network decided to establish a working group to campaign on the proposed US-India nuclear deal. Many individuals and organizations have since been campaigning their governments, in particular the US, India, and countries that belong to the Nuclear Suppliers Group. In January 2008, the US-India Working Group issued a call on states to “Fix the Proposal for Nuclear Cooperation with India” that has also been endorsed by INESAP. In many countries, the call received considerable media attention.

Below, an extract of the media advisory and the open letter sent to foreign ministers of governments represented on the NSG and on the IAEA Board of Governors are documented.

(Washington, D.C.-Tokyo, Japan; 9 January 2008) In a letter sent to more than four-dozen governments this week, a prestigious and broad array of more than 120 experts and nongovernmental organizations from 23 countries said the U.S. proposal to exempt India from longstanding global nuclear trade standards “would damage the already fragile nuclear nonproliferation system and set back efforts to achieve universal nuclear disarmament.”

The international appeal to Fix the Proposal for Nuclear Cooperation with India calls upon governments “to play an active role in supporting measures that would ensure this controversial proposal does not: further undermine the nuclear safeguards system and efforts to prevent the proliferation of technologies that may be used to produce nuclear bomb material,” or “in any way contribute to the expansion of India’s nuclear arsenal.”

Among the experts endorsing the appeal is Amb. Jayantha Dhanapala, the former UN Under-Secretary General for Disarmament Affairs and President of the 1995 Nuclear Nonproliferation Treaty Review and Extension Conference. Nongovernmental organizations from South Asia, East Asia, Australia and New Zealand, Europe, Africa, and North America endorsed the letter, which was organized by the Tokyo-based Citizens’ Nuclear Information Center and the Washington-based Arms Control Association.

In the coming weeks, the 35-member International Atomic Energy Agency (IAEA) Board of Governors and the 45-member Nuclear Suppliers Group (NSG) will likely take up the issue. The appeal is part of a global NGO campaign to influence governments’ views about the controversial nuclear trade proposal.

Current international guidelines severely restrict trade with states, such as India, that do not allow comprehensive international safeguards over all nuclear facilities and material in their territory. The 1968 nuclear Nonproliferation Treaty (NPT) bars direct or indirect assistance of another state’s nuclear weapons program. India, which detonated a nuclear bomb in 1974 made with plutonium harvested from a Canadian and U.S.-supplied reactor in violation of bilateral peace nuclear use agreements, has not joined the NPT, continues to produce fissile material for nuclear weapons, and has not signed the Comprehensive Nuclear Test Ban Treaty (CTBT).

Nevertheless, in July 2005, U.S. President George Bush pledged to seek changes in longstanding U.S. laws and international guidelines to permit increased civil nuclear trade with India. In return, Indian Prime Minister Manmohan Singh pledged to allow additional IAEA oversight of certain Indian nuclear reactors under a new “India-specific” agreement now being negotiated with the Agency. …

Letter: “Fix the Proposal for Nuclear Cooperation with India”

Dear Foreign Minister

In the coming weeks the International Atomic Energy Agency (IAEA) Board of Governors will likely be asked to consider a new “India-specific” safeguards agreement that would cover a limited number of additional “civilian” reactors. Shortly thereafter, the members of the 45-nation Nuclear Suppliers Group (NSG) will be asked to take a position on the Bush administration’s proposal to exempt India from longstanding NSG guidelines that require full-scope IAEA safeguards as a condition of supply.

Contrary to the claims of its advocates, the proposed arrangement fails to bring India further into conformity with the nonproliferation behavior expected of other states. India’s commitments under the current terms of the proposed arrangement do not justify making far-reaching exceptions to international nonproliferation rules and
norms. Consequently, the proposed arrangement would damage the already fragile nuclear nonproliferation system and set back efforts to achieve universal nuclear disarmament.

We are writing to urge your government to consider the full implications of the proposed agreement and to play an active role in proposing and supporting measures that would help ensure that this controversial proposal does not:

- further undermine the nuclear safeguards system and efforts to prevent the proliferation of technologies that may be used to produce nuclear bomb material;
- in any way contribute to nuclear proliferation and/or the expansion of India’s nuclear arsenal; or
- otherwise grant India the benefits of civil nuclear trade without holding it to the same standards expected of other states parties of the nuclear Non-Proliferation Treaty (NPT).

- Because the NSG and IAEA traditionally operate by consensus, your government has a pivotal role to play. Please consider the following:

  1. India is seeking unprecedented “India-specific” safeguards over the additional facilities it has declared “civilian”. Such safeguards could allow India to cease IAEA scrutiny if fuel supplies are cut off because it renews nuclear testing. Indian officials suggest that they will seek safeguards that are contingent upon the continued supply of nuclear fuel from foreign suppliers. India may also assert that it has the option to remove certain “indigenous” reactors from safeguards if foreign fuel supplies are interrupted, even if that is because it has resumed nuclear testing. Such proposals should be rejected whether they might be included in the actual safeguards agreement or accompanying statements.

    As part of the final document of the 1995 NPT Review and Extension Conference, all NPT states parties endorsed the principle of full-scope safeguards as a condition of supply. A decision by the 45-nation NSG to exempt India from this requirement for India would contradict this important element of the NPT bargain.

    We urge your government to actively oppose any arrangement that would give India any special safeguards exemptions or which would in any way be inconsistent with the principle of permanent safeguards over all nuclear materials and facilities.

  2. India pledged in July 2005 to conclude an Additional Protocol to its safeguards agreement. Given that India maintains a nuclear weapons program outside of safeguards, facility-specific safeguards on a few additional “civilian” reactors provide no serious nonproliferation benefits. States should insist that India conclude a meaningful Additional Protocol safeguards regime before the NSG takes a decision on exempting India from its rules.

  3. The United States has put forward a draft NSG guideline that would allow NSG states to continue providing India with nuclear supplies even if New Delhi breaks its nuclear test moratorium pledge. Indian officials say they want changes to NSG guidelines that do not impinge upon their ability to resume nuclear testing. The U.S. proposal on India at the NSG would, in the case of a resumption of nuclear testing by India, make the suspension of nuclear trade optional for NSG member states. Such an approach would undercut the international norm against nuclear testing and make a mockery of NSG guidelines. If the NSG members agree by consensus to exempt India from the full-scope safeguards standard, they should in the very least clarify that all nuclear trade by NSG member states shall immediately cease if India resumes nuclear testing for any reason.

  4. India is seeking exemptions from NSG guidelines and IAEA supply guarantees that would allow supplier states to provide India with a strategic fuel reserve that could be used to outlast any fuel supply cut off or sanctions that may be imposed if it resumes nuclear testing. The U.S.-India bilateral nuclear cooperation agreement includes political commitments to support an Indian strategic fuel reserve and an “India-specific” fuel supply arrangement. If NSG supplier states should agree to supply fuel to India, they should do so in a manner that is commensurate with ordinary reactor operating requirements.

  5. India is seeking and the United States has proposed an NSG guideline that would open the way for other nuclear suppliers to transfer sensitive plutonium reprocessing, uranium enrichment, or heavy water production technology to India even though IAEA safeguards cannot prevent such technology from being replicated and used in its weapons program. India detonated a nuclear device in 1974 that used plutonium harvested from a heavy water reactor supplied by Canada and the United States in violation of bilateral peaceful nuclear use agreements. U.S. officials have stated that they do not intend to sell such technology, but other states may. Virtually all NSG states support proposals that would bar transfers of these sensitive nuclear technologies to non-NPT members and should under no circumstances endorse an NSG rule that would allow the transfer of such technology to India.

  6. Absent a decision by New Delhi to halt the production of fissile material for weapons purposes, foreign fuel supplies would allow India not only to continue but also to potentially accelerate the buildup of its stockpile of nuclear weapons materials. This would not only contradict the goal of Article I of the NPT, but it would also foster further nuclear competition between India and Pakistan. Has your government conducted an independent assessment
of the impact of foreign fuel supplies on India’s weapons production capacity and the security balance in South Asia?

7. UN Security Council Resolution 1172 calls on India and Pakistan to sign the Comprehensive Test Ban Treaty (CTBT) and stop producing fissile material for weapons. Your government is bound by the UN Charter to support the implementation of this resolution. Before India is granted a waiver from the NSG’s full-scope safeguards standard, it should join the other original nuclear weapon states by declaring it has stopped fissile material production for weapons purposes and, like the 177 other states that have signed the CTBT, make a legally-binding commitment to permanently end nuclear testing. India’s verbal commitment to support negotiations of a global verifiable commitment to permanently end nuclear testing is a hollow gesture given the fact that states have failed to initiate negotiations on such a treaty for over a decade.

Conclusion
If your government is truly dedicated to the goal of stopping the spread of nuclear weapons, ending nuclear arms races, and strengthening rules governing the transfer of nuclear material and technology, it will insist upon these and other vital nonproliferation measures. We look forward to your responses to our questions and recommendations.

January 7, 2008

The full list of more than 120 endorsements is available at http://cnic.jp/english/topics/plutonium/proliferation/usindiafiles/nsgiaea7jan08.html.

Contacts for this initiative: DARYL KIMBALL, Exec. Director, Arms Control Association, tel. 1-202-463-8270 x107; PHILIP WHITE, Citizens’ Nuclear Information Center, Tokyo, and Coordinator, Abolition 2000 U.S.-India Deal Working Group, tel. 81-3-3357-3800; white@cnic.jp.

United Nations Cyberschoolbus

Cyberschoolbus, an online education project of the United Nations Department of Public Information, has a major section on Disarmament & Non-Proliferation at http://cyberschoolbus.un.org/dnp.

Objectives
The web portal has two main objectives:

1. To provide teachers and students from late middle school to early college with resources to raise awareness about the proliferation of weapons, the differing views about the role these weapons play in maintaining security or a culture of violence, their impact on the environment, and efforts underway to help prevent the violence associated with weapons.

2. To give teachers a basic overview of the issues and concepts that students will need to understand to engage in discussions on the threats posed by weapons of mass destruction and the complex issues associated with the trade of conventional weapons and to contribute new ideas on what should be done to reduce the threats they might pose.

Nuclear weapons are still one of the greatest threats to life on earth. Other types of weapons of mass destruction – biological, chemical, radiological – or the excessive accumulation of conventional weapons also pose significant threats to peace and security. Young people need to be aware of the dangers associated with each type of weapon and to feel empowered to participate in the debate on how best to respond to the threats they pose to international peace and security.

How the Overview is Organized
To assist teachers in introducing disarmament and non-proliferation issues into the classroom, this overview is divided into five main sections:

Disarmament and Non-Proliferation Education: This section outlines why it is important to engage young people in learning about disarmament and non-proliferation issues and provides teachers with an overview of educational strategies along with examples of interactive techniques that can be used in the classroom.

Categories of Weapons: This section will help teachers and students understand the different types of weapons that are referred to in international agreements. Disarmament and non-proliferation issues associated with each weapon category are outlined as well.

Disarmament and non-proliferation and Security: Achieving international peace and security is the ultimate aim of disarmament and non-proliferation efforts. To understand these efforts better, this section examines the concept of security and how the study of security issues has developed. National security interests are differentiated from the security interests of individual human beings to add depth to this discussion. Implications for disarmament and non-proliferation policies are explored.

UN Role: This is where you will find a description of the various UN entities involved in supporting disarmament and non-proliferation as well as a short description of important disarmament agreements.

Discussion Starters: Throughout these sections, questions and inquiries are suggested that the educator may choose to use with learners. This section allows you to skim the wide range of inquiries that are scattered throughout the disarmament and non-proliferation website. Useful links for further research are also provided.
On 13 February 2007, at the fifth round of the six-party talks between North Korea, China, Japan, Russia, South Korea, and the United States, an agreement was signed by the participating governments which could potentially lead to the stop of the North Korean nuclear program. Years of negotiations, with many disappointments, preceded this round of talks, and many issues still remain unresolved. Prior to the governments’ accord on joint efforts for a smooth implementation of a road map, a similar agreement had been signed in September 2005. In the North Korean issue, signs of progress have always been followed by breakdowns or stalemates of the six-party talks.

Phases of Rising Tensions

On 9 October 2006, North Korea conducted an explosive underground nuclear test in pursuit of its ambition to become a nuclear weapon state. With this explosion the North Korean genie is out of the bottle. It was the last of a series of provocative acts which led the United Nations Security Council – under Resolution 1718 of 14 October 2006 – to call for sanctions against that country.

For several years, arms control diplomacy had tried for several decades to stop the DPRK nuclear program. In a first phase during the 1980s, the US government tried successfully, in cooperation with the Soviet Union, to convince North Korea to join the NPT. The country acceded to the treaty in 1985 and allowed inspections of the International Atomic Energy Agency (IAEA) in 1992 after lengthy and controversial negotiations. The two Koreas signed a bilateral agreement in 1991 aiming at the denuclearization of the Korean peninsula. So far, this policy has not been implemented since no agreement on bilateral inspections could be reached.

In a second arms control phase, the so called Agreed Framework, was signed in 1994 between the United States and North Korea. Economic assistance, the promise to deliver two light-water reactors and international pressure persuaded the isolated Kim government to stop the construction of its nuclear plants in Yongbyong. Disagreement arose between the International Atomic Energy Agency (IAEA) and the North Korean government about the existence of plutonium generated in a 5 MW graphite reactor which had been completed in 1986. While North Korea claimed that just a few grams of plutonium could not be accounted for, IAEA inspectors reported missing an estimated 15 kg plutonium separated by reprocessing of 8000 fuel rods. This material would be sufficient for the production of a few nuclear war heads.

In a third phase, the Bush Administration charged North Korea in October 2002 with secretly engaging in a uranium enrichment program. Washington suspected that North Korea had, in breach of the Agreed Framework, engaged on a secret parallel path towards acquiring nuclear weapons material. Prior to that, in August 1998, the test of a long-range Taepo-dong-1 missile raised tensions in the region that had been eased temporarily by additional US food supplies and a North Korean moratorium on the test of long-range missiles. The export of missile technology by North Korea, however, has continued all the while. The DPRK government claims until today that this technology is exported exclusively for economic profit and that an export stop would have to be compensated for by international assistance.

The rising tension and the war of words between Pyongyang and Washington escalated after the October 2002 confrontation about the alleged uranium enrichment. The Kim government withdrew from its NPT membership on 10 January 2003 and declared to possess nuclear weapons on 10 February 2005. The North Korean government responded to pressure from the Bush Administration by withdrawing from international agreements and testing a nuclear device on 9 October 2006.

Defiantly, Kim Jong Il’s government called the UN sanctions a declaration of war on the grounds that the UN resolution “was based on the scenario of the US keen to destroy the socialist system of Korean-style.” The question for the international community was and still is: what can be done to reverse North Korea’s nuclear weapons programme, to try to get the genie back into the bottle, and to uphold the credibility of the nuclear non-proliferation regime? Or is it naïve to believe that nuclear ambitions will ever be given up once weapons have been produced? North Korea’s policy can be seen as the test for the future viability of the NPT and as a confrontation of the UN in its role as the guardian of arms control treaties. The policy of North Korea demonstrates a strong ambition to create a nuclear and a long-range missile program. But at the same time, the Kim government has always maintained that it continues to pursue a pol-
icy of complete denuclearization and that it is ready to negotiate the stop of its program.

Although the September 2005 round of negotiations led to a joint declaration on a road map, the major stumbling block was the sequence of steps to be taken. Who will make the first step and what follows next? How intrusive can IAEA inspections be? When – if at all – will light-water reactors be supplied to North Korea? And what is the status of the highly enriched uranium program in the DPRK? A further complication which delayed negotiations during 2006 were US financial sanctions against the DPRK, which severely harmed the North Korean economy. Indeed, one can argue that the nuclear test may have been an act primarily designed to reverse these financial sanctions.

Varied interests

The lack of progress during the first few rounds of the six-party talks, which were moderated by China, was mainly due to the tough stance of both the governments of the DPRK and the United States. While the US government requested a “complete, verifiable, and irreversible” stop of the nuclear program as a precondition for negotiations, the DPRK government wants to pursue a step-by-step approach with actions on both sides, but first of all a security guarantee by the United States.

In addition, the six-party talks have always suffered from a lack of common interest among the participating governments. Internal politics play an important role both in Pyongyang and in Washington. Nothing less than the survival of the Kim government is at stake in North Korea. During the negotiations, the North Korean government left the negotiating table several times. This behavior must be seen against the background of competing economic, political, and security interests. The North Korean economy is in a state of despair. Lack of food has led to catastrophic malnutrition for millions of North Koreans and to the death of probably several hundred thousands if not millions of people. Energy shortages affect industrial production, cause constant breakdowns of the public transportation system, and result in insufficient heating during the cold winters. Several donors have withdrawn from North Korea in explicit reaction to the nuclear program.

Judgment about North Korea’s internal politics must remain speculative since very little information about the isolated regime is available. Nevertheless, a few scenarios seem plausible:

1. Nuclear weapons as a determent: North Korean officials have repeatedly emphasized that they feel “cornered” by US pressure. Especially the US National Security Strategy of 2002 with the emphasis on “preemptive” strikes rings alarms bells in Pyongyang. It seems that the military sees the quest for nuclear weapons as an important deterrent against a possible US military invasion. This scenario presumes that North Korea never took the negotiations and its international commitments under the NPT and the Agreed Framework seriously.

2. Nuclear weapons as a bargaining chip: The North Korean government is prepared to stop its nuclear program if it gets compensated by security guarantees and economic assistance and cooperation. Both the Agreed Framework of 1994 and the February 2007 Beijing agreement point to that direction. North Korea’s official position has always been to emphasize its willingness for negotiations if the conditions are right.

3. Pursuit of parallel options: The DPRK government pursues parallel options of building up its nuclear and missile program while negotiating its complete dismantlement at the same time. This seems a plausible scenario as long as the Kim government feels threatened. One of the more fundamental reasons for the repeated negotiation deadlock in the past is that the five countries involved with North Korea have no uniform interests in the region. While they all want to stop the nuclear program, the means of doing so vary greatly. Whereas the US favours...
isolating Kim Jong Il’s regime or even forcibly changing it, China, Russia, and to some extent South Korea, prefer economic and political engagement. Hence, the latter trio has been reluctant to pursue the strict sanctions favoured by the Bush Administration. In the absence of consensus, North Korea seems to get away with its policy of brinkmanship. In principle there appear to be five approaches which could be pursued by the international community:

1. **Wait and see:** This policy seems risky since North Korea continues to improve its nuclear and missile capability. Simply “playing for time” is more likely to see the situation deteriorate rather than improve.

2. **Military measures:** Launching a military strike against North Korea – either by trying to deliver a decisive blow against its nuclear weapons facilities or by seeking to overthrow the regime – are unlikely to succeed and more probable to precipitate a major war on the Korean peninsula in which many thousands of innocent Koreans would die.

3. **Isolation:** Move beyond making North Korea merely an international outcast and completely isolate the country by ending all communication. Given past experience, however, it seems doubtful that the North Korean government would give in to such pressure. External pressure has led North Korea to “tighten its belt.” For an isolation policy to be successful, the unlikely agreement of all other parties would be required.

4. **Forced regime change:** How would this be brought about? Ruling out military actions, so far the Bush Administration has offered rhetoric rather than a concept for overthrowing the governments of “rogue states.” Except for the US government, none of the states involved favours an abrupt collapse of the regime in Pyongyang: the consequences would be incalculable, especially for South Korea and China who would have to cope with millions of refugees.

5. **Economic engagement and security guarantees:** Given North Korea’s dire economic and social conditions, the DPRK government has repeatedly announced that it is prepared to cooperate with the international community and to stop its nuclear weapons program if US nuclear weapons are verifiably withdrawn from South Korea and the DPRK receives security guarantees and economic assistance. It might be worth to look into details about possible conditions of such cooperation and the likely price of North Korean compliance.

Already during the Clinton Administration, proponents of a tough North Korea policy maintained the position that the “blackmail” policy of North Korea should not be honoured by cooperation with this “rogue state.” Others, in contrast, emphasized that policy aims such as regime change or human rights improvements should have a lower priority than attempt to stop the nuclear and missile programs. While the Clinton Administration pursued a policy of “carrots and sticks,” the Bush Administration switched to a policy of pressure and isolation of North Korea. This course of action, however, was controversially assessed within the Administration. Thus, no coherent North Korea policy was applied. While the State Department, both under Colin Powell and Condoleezza Rice, occasionally signalled willingness for cooperation and negotiations, the Department of Defense and the Office of the Vice President pursued their hard-line policy. Charles L. Pritchard, the former North Korea special envoy of the Bush Administration, blames the government for having made a mess of the negotiations with the Kim government. The result is over half a dozen bombs’ worth of plutonium, the departure of North Korea from the NPT, and a nuclear test.

After the October 2002 showdown about the alleged North Korean highly enriched uranium program, which was the starting point for the present nuclear crisis, the North Koreans reacted with anger and declared: “Nobody would be so naive as to think that the DPRK would sit idle under such situation.” Furthermore they declared that “the DPRK was entitled to possess not only nuclear weapons but any type of weapon more powerful than that so as to defend its sovereignty and right to existence from the ever-growing nuclear threat by the U.S.” Interestingly, the evidence for the existence of a HEU program was rather weak, and probably the US government offered a face-saving way for both sides to defuse their differences on this issue in its bilateral negotiations with North Korea in March 2007 in New York. Now, five years after the “axis of evil” speech, the Bush Administration finds itself signing an agreement that is almost identical to the one negotiated by the Clinton Administration and

![Figure 2: Displaying the origins of the official policy in Pyongyang](image-url)
criticised so heavily by Bush. It looks like a complete reversal of the US North Korea policy.

But before this latest turn of events, the Bush government made a number of conceptual, strategic and tactical mistakes: Conceptually, it was wrong to assume that North Korea would give in to US pressure. On the contrary, hard-line reactions in Pyongyang were the answer to US hard-line rhetoric and sanctions. Strategically, it was a mistake to label North Korea as part of the “axis of evil,” thus assuming that the Kim government is at the same level as al Qaeda in the US “war on terror.” On the tactical level, the Bush Administration failed to design a coherent North Korea policy with several shifts back and forth between diplomatic signals and hard-line policies.17

China plays an important role as a moderator in the negotiations. It has an interest in the stability of the region and pursues two main aims: to stop the nuclear program and to prevent an abrupt regime change in North Korea. A nuclear Korea could lead to a domino effect in South East Asia with Japan, South Korea, and possibly Taiwan as emerging nuclear powers. The breakdown of the present regime in Pyongyang is not in China’s interest, and under no circumstances has China an interest in a united Korea under US dominance. Thus, China pushed the six-party talks by putting pressure on North Korea and reminding the US government that it has to put something substantially on the table in order to stop North Korea’s nuclear weapons programme. Similarly, South Korea does not want North Korea to implode in a democratic revolution or a popular uprising. Seoul would rather want a slow process of transformation of the North to open up a road to eventual unification.

A Shift in Policy: Entering Reality

The February 2007 Beijing agreement is a breakthrough in this long-lasting nuclear crisis. But the North Korean nuclear program has not yet been stopped, and the open questions of the September 2005 roadmap have not to be answered yet. As compared to the last decades, however, there is now reason for some optimism. In the agreement the six parties reaffirmed their common goal of denuclearization of the Korean peninsula and committed to take the following coordinated steps:

1. The DPRK will shut down and seal for the purpose of the eventual abandonment the Yongbyong nuclear facility and invite the IAEA for inspections.
2. The DPRK will discuss with the other parties a list of all relevant nuclear programs.
3. The DPRK and the US will start bilateral talks with the aim of full diplomatic relations.
4. The DPRK and Japan will start bilateral talks aimed at normalization of relations.
5. The parties agreed to cooperate in economic, energy, and humanitarian assistance to the DPRK.18

The sealing of the Yongbyong nuclear facility would take place within 60 days in return for a first delivery of 50.000 tons of fuel oil; in total up to the equivalent of 1 million ton of heavy fuel oil would be supplied. The first steps in this direction have been taken. IAEA inspectors have signalled North Korean compliance. During the US-North Korea talks in September 2007 North Korea agreed to disclose all of its nuclear activities and disable its nuclear programs by the end of 2007. In the meantime, the first supplies of fuel oil arrived in North Korea. The October 2007 meeting of the South Korean President, Roh Moo Hyun, with Kim Jong Il in Pyongyang, after a lapse of contact over seven years, is a hopeful sign.

Why was this landmark agreement possible now? It is mainly pressure on the main players which made the February 2007 Beijing agreement achievable. Three main reasons are obvious:

1. The North Korean nuclear test of October 2006 made it absolutely clear to the international community that the nuclear crisis had reached a critical stage. Despite doubts on the technical capabilities of the North Korean nuclear engineers and scientists, it became clear that the Kim...
government did not only bluff (as was the case in October 2005) but that it wanted to push its way into the exclusive nuclear club. If further nuclear proliferation was to be prevented, immediate action was required.

2. The North Korean government too was under pressure. The sanctions agreed upon in the UN were intended to restrict the import of goods and services by North Korea even further. Importantly, the Chinese government reduced its economic assistance, especially food and oil supplies. In unusually harsh language the Chinese called North Korea’s behaviour “brazen,” a term Beijing used the last time decades ago during the tensions with the United States. Beijing made it clear to its erstwhile communist ally and friend that it would not tolerate a nuclear armed North Korea and played a classical policy of “carrots and sticks.” As soon as North Korea signalled its preparedness to return to the six-party talks, China increased its economic assistance to North Korea.

3. The agreement marks a major change of course for the Bush Administration, which has been beset by six years of internal arguments whether to negotiate with North Korea or to squeeze the Kim government until it collapses. This surprising turn-around of the Bush Administration’s North Korea policy made the February 2007 Beijing agreement possible. Given the fact that the US is bogged down in Iraq, the increasing problems and lack of progress in Afghanistan, and the looming nuclear crisis with Iran, Bush needed a foreign policy breakthrough on another front. Furthermore, China, South Korea, and Russia have strongly urged the US to seriously negotiate with North Korea. Over six years the US government had refused direct negotiations with the Kim government and had insisted on a stop of the nuclear program as a precondition for negotiations about Korean security, diplomatic recognition, and economic assistance. This position has been given up now, although critics like John Bolton, the former US ambassador to the United Nations, continue to criticise the agreement since, according to him, it rewards North Korea with delivery of fuel and assistance before the country’s nuclear capacity is dismantled. The present agreement is based on a step by step or action for action approach. Furthermore, the US government agreed to discuss the financial sanctions against North Korea and indicated that some of the funds blocked by the US in a bank in Macau could be legally transferred to the DPRK. Many controversial issues still need to be resolved, and the discussions in the working groups agreed upon in the February Beijing agreement have already proved difficult and painstaking. How intrusive will IAEA inspections be and what will they tell us about the US claim of the clandestine HEU program which was the starting point for the crisis in 2002? Did the Kim government lie about this program or was the US claim unsubstantiated? Who might lose their face? What will the inspections uncover about the nuclear test? Was it largely a technical failure as Western experts presume and did the Kim government bluff without a joker in her hands? Is the US shift in policy sustainable, and will the government eventually give the North Koreans the much wanted security guarantees? Will North Korea really give up its nuclear weapons and agree to dismantle all nuclear facilities with relevance for military use for good? North Korea has been famous for driving a hard bargaining position: What will the economic price tag for the international community be?

At the time of writing, the February 2007 agreement is implemented according to plan. Thus, there is reason for optimism. A team of experts, led by the United States, started work early in November 2007 to disable three of the Yongbyong nuclear facilities: the reactor, the plant that fabricates reactor fuel from natural uranium, and the chemical reprocessing plant where weapons-grade plutonium is separated from the spent fuel-rods. Whether those nuclear facilities will eventually not only be disabled but fully dismantled is still open. It seems, however, that North Korea has shifted its attitude. While in the past North Korea often simply refused to cooperate in the technicalities, now they are trying to convince US experts that they are serious in their efforts to make the agreement a success. The North Korean readiness is rewarded by intensified economic assistance. China has just announced to set up a 10 billion dollar fund to help Chinese firms to build infrastructure in the impoverished country. South Korea continues to supply economic assistance and proposed a meeting of the leaders of the United
States, China, North Korea, and South Korea to formally end the war that has split the Korean peninsula for more than 50 years.

There is one important lesson from the North Korean nuclear policy and its underground test: the international community needs to negotiate directly even with hostile regimes and there is reason to hope for a reversal even of nuclear programs.

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1 The official name of the country is Democratic Peoples’ Republic of Korea (DPRK).
3 The Agreed Framework included a provision that two reactors with a capacity of 50 and 200 MW would not be completed. If they were to be completed they had a capacity to generate a total of 275 kg plutonium per year, enough for 35 to 50 nuclear warheads. See the report of the CIA to the US Congress, 19 November 2002, published on the Website of the Federation of American Scientists; www.fas.org/nuke/guide/dprk/nuke/cia111902.html.
5 According to the US head of the delegation James Kelly, the North Korean Deputy Foreign Minister Kim “angrily denied that the DPRK had a highly enriched uranium (HEU) program. He dismissed my statement, claiming it was a fabrication.” In the final meeting, the First Deputy Foreign Minister Kang Sok Ju reacted, according to Kelly in the following way: “Kang… surprised me by making it quite clear, even before I was able to make my presentation, that North Korea was proceeding with an HEU program and that it considered the Agreed Framework to be ‘nullified.’” Quoted in Jonathan D. Pollack, The United States, North Korea, and the End of the Agreed Framework, in Naval War College Review, 3/2003 (Summer), p. 16; www.nwc.navy.mil/press/Review/2003/Summer/art1-su3.htm.
6 See Korean Central News Agency (KCNA), 18 October 2006; www.kcna.co.jp/index-e.htm.
7 This has literally been mentioned so by DPRK officials from the Foreign Ministry to the author during several of his visits to Pyongyang. The invasion of Iraq is repeatedly quoted as proof for US aggressiveness.
8 These scenarios and their repercussions have been detailed by the author: Herbert Wulf, Nordkoreas Griff zur Bombe, Studien der Stiftung Wissenschaft und Politik, Berlin, Studie Nr. 14, June 2006; www.swp-berlin.org/de/common/get_document.php?id=1733.
9 According to public information (see the Nuclear Information Project at www.nukestrat.com/korea/withdrawal.htm), the United States withdrew the last nuclear weapons from South Korea in December 1991. North Korea wants to have proof of this and wants an agreement on the “denuclearization of the Korean peninsula.”
13 He is quoted by Nicholas D. Kristof in the New York Times of 27 April 2005 with the words: “They blew it.”
15 A 19 November 2002 CIA Report said: “The United States has been suspicious that North Korea has been working on uranium enrichment for several years. However, we did not obtain clear evidence indicating the North had begun constructing a centrifuge facility until recently. We assess that North Korea embarked on the effort to develop a centrifuge-based uranium enrichment program about two years ago.” www.fas.org/nuke/guide/dprk/nuke/cia111902.html.
16 It is speculated in press reports that there are “gaps” in the US knowledge of the uranium enrichment program. See Reuters, 22 February 2007, and New York Times, 1 March 2007.

This article was written for the INESAP Information Bulletin in November 2007.
In 1997, non-governmental organizations published a model Nuclear Weapons Convention (NWC), which was revised and updated in 2007. The document proposes the complete elimination and ban of nuclear weapons by international law, an approach that is generally supported by the majority of the international community.

For the past decade, the international security landscape has been dominated by elements that have kept comprehensive nuclear disarmament in the distant future. With the end of the Bush Administration approaching, discussion of nuclear risks and disarmament alternatives once again are visible in the mainstream, and support for a nuclear-weapon-free world again is on the rise.

Nuclear Risks

The nuclear threat did not disappear with the end of the Cold War. On the contrary, while the nuclear weapon states have reduced their nuclear arsenals, they never abandoned the nuclear arms race. Tens of thousands of nuclear weapons still exist, with thousands still actively deployed. With nuclear deterrence still in place, the risks of nuclear war remain imminent. Hundreds of tons of nuclear-weapons usable materials remain as well, and with the projected increase of nuclear energy the precursors for nuclear weapons development also are proliferating. The possibility that nuclear weapons or sensitive nuclear materials could fall into the hands of terrorists cannot be ruled out.

The 1970 nuclear Non-Proliferation Treaty (NPT) recognized the USA, Russia, France, the United Kingdom and China as acknowledged nuclear weapon states. Since then, four more states have acquired nuclear weapons: Israel, India, Pakistan, and North Korea. The nuclear potential of Iraq was destroyed in 1991 by military force. The mere possibility that Iran also could develop nuclear weapons is driving the arms race, and is used by the US government to build a case for possible military intervention and for the installation of missile defenses in Eastern Europe. The harsh reactions from Russia are reminiscent of Cold War rhetoric, and demonstrate that horizontal proliferation can drive vertical proliferation between the major powers. The nuclear weapons states have not made serious efforts to fulfill their disarmament promises given in Article VI of the NPT; their failure to do so can be used by nuclear newcomers as an excuse to discredit the non-proliferation regime.

In his last speech, former UN General Secretary Kofi Annan made a strong case for nuclear disarmament, emphasizing that nuclear weapons “pose a unique threat to humanity as a whole.” Half-hearted measures to manage the current crisis cannot prevent its intensification, rather, they worsen the problems. The NPT, which was partially successful in containing the spread of nuclear weapons, will be at a crossroads in the coming years. Either the nuclear disarmament obligation is implemented, or the whole non-proliferation regime is at risk. The long-term threat of nuclear war can only be avoided by a comprehensive and universal norm for banning nuclear weapons. A Nuclear Weapons Convention would be a logical way to complete the ban on all weapons of mass destruction, together with the Biological and Chemical Weapons Conventions. It would also fulfill the first UN General Assembly Resolution, which called unanimously for the “the elimination from national armaments of atomic weapons.”

From a Lost Decade to the Decade of Nuclear Disarmament?

In the mid-1990’s, the political conditions for a world without nuclear weapons appeared to be quite favorable. The Cold War was over, the giant nuclear arsenals were obsolete, and the hopes for military conversion and a peace dividend loomed large. The call for a nuclear-weapon-free world increasingly shaped the international debate. A major high point was the NPT Review and Extension Conference held in New York in April/May 1995. A Study Group of the International Network of Engineers and Scientists Against Proliferation (INESAP) presented a report in New York which emphasized the need for a Nuclear Weapons Convention (NWC). The founding statement of the new global network Abolition 2000 called for negotiations on a NWC as a central point. Several significant disarmament developments followed in the year and a half after the 1995 NPT extension. In its July 1996 Advisory Opinion, the International Court of Justice affirmed that “there exists an obligation to pursue in good faith and bring to a conclusion negotiations on nuclear disarmament in all its aspects under strict and
The urgent need for the abolition of nuclear weapons has not declined in recent years, and the public support for their elimination has not diminished. According to a 1997 poll of US citizens, 87% agreed that “the US should negotiate an agreement to eliminate nuclear weapons.”4 In a recent poll in France, Italy, Germany, Belgium, Turkey, and Great Britain, 69% said that they want to see Europe free of nuclear weapons.5 The efforts of the international movements against nuclear weapons have continued as well:

- Several resolutions have been introduced into the US House of Representatives supporting a Nuclear Weapons Convention (submitted by Congress members Lynn Woolsey, Dennis Kucinich and Eleanor Holmes Norton).6
- On October 3, 2000, 70 prominent US citizens released a statement in the New York Times calling upon the US government “to commit itself unequivocally to negotiate the worldwide reduction and elimination of nuclear weapons, in a series of well-defined stages accompanied by increasing verification and control.”7
- The 2001 US Conference of Mayors, the 2006 World Council of Churches and the 2006 meeting of Nobel Prize winners each adopted resolutions for the elimination of nuclear weapons.8
- More than 2,000 mayors have joined the Mayors for Peace initiative. In their 2020 Vision campaign, they call for the conclusion of negotiations on a Nuclear Weapons Convention by 2010, with the goal of eliminating nuclear weapons by 2020.
- In October 2005, the Middle Powers Initiative launched the Article VI Forum, which aims to bring together like-minded middle power states to “identify the legal, political and technical requirements for the elimination of nuclear weapons,” and to explore “ways to start negotiations on disarmament steps leading to a nuclear weapons convention or a framework of instruments for the abolition of nuclear weapons.”9 About 40 governments already have attended the conferences of the Article VI Forum (in New York, The Hague, Ottawa and Vienna, followed by Dublin in March 2008), in preparation for the NPT Review Conference in 2010.
- Another major initiative is the Weapons of Mass Destruction Commission, under the leadership of Hans Blix. Its 2006 report Weapons of Terror dispels “the perception that outlawing nuclear weapons is a utopian goal. A nuclear disarmament treaty is achievable and can be
reached through careful, sensible and practical measures.” The Commission calls for states to “accept the principle that nuclear weapons should be outlawed, as are biological and chemical weapons (i.e. by a comprehensive abolition treaty), and explore the political, legal, technical and procedural options for achieving this within a reasonable time. Benchmarks should be set; definitions agreed; timetables drawn up and agreed upon; and transparency requirements agreed. Disarmament work should be set in motion.”

The Debate in the USA

Part of the US establishment seems to recognize that the continued existence of nuclear weapons undermines the security of the United States. The more proliferation progresses, the less existing nuclear overkill capacities are seen as a security guarantee for the major nuclear weapon states. In the past decade, former US Secretary of Defense Robert McNamara, former President Jimmy Carter, former Commander of US Strategic Command General Lee Butler, and others came to the conclusion that the abolition of nuclear weapons is the best strategy to end the risk of a nuclear disaster.

This view has found support from former US Secretaries of State Henry Kissinger and George Schultz and former Secretary of Defense William Perry, as well as former U.S. Senate Armed Services Committee Chairman Sam Nunn. Based on their experience with nuclear weapons policy and strategy, they see the continued reliance on nuclear weapons as “increasingly hazardous and decreasingly effective.” They predict that without a major change in policy the US soon will enter a “new nuclear era that will be more precarious, psychologically disorienting, and economically even more costly than was Cold War deterrence.” Recalling the 1986 Reykjavik Summit between former Presidents Reagan and Gorbachev, they support the goal of a nuclear-weapon-free world and activities to reach that goal. In their view, leadership by the United States would be essential to diminish dependence on nuclear weapons and to prevent nuclear proliferation: “Without the bold vision, the actions will not be perceived as fair or urgent. Without the actions, the vision will not be perceived as realistic or possible.”

Along these lines, the former British Foreign Minister Margaret Beckett at the end of her term made a speech at the annual non-proliferation conference of the Carnegie Endowment for International Peace in June 2007. She made clear that, as with the abolition of slavery, the ultimate goal would not be regulation or reductions, but the elimination of nuclear weapons. Referring to her US colleagues she said: “What we need is both vision – a scenario for a world free of nuclear weapons. And action – progressive steps to reduce warhead numbers and to limit the role of nuclear weapons in security policy. These two strands are separate but they are mutually reinforcing. Both are necessary, both at the moment too weak.”

Non-Proliferation vs. Disarmament: No Contradiction

While there is general agreement about the ultimate goal of a nuclear-weapon-free world, there are different views about the best path towards that goal. Kofi Annan criticized the polarization between those who place a priority on non-proliferation, seeking first to deny others access to nuclear weapons, and those disarmament proponents who make non-proliferation dependent on progress in nuclear disarmament. According to Annan, work on non-proliferation and disarmament have to proceed together.

There are differences as well regarding whether only single steps are to be negotiated, or whether the overall goal of a nuclear-weapon-free world should be more clearly envisioned from the outset. In an incremental approach, only the next step is on the agenda, without a consistent strategy towards zero. An example is the 1995 NPT Principles and Objectives for Nuclear Disarmament and Non-Proliferation, which were further elaborated by a set of 13 practical steps agreed to at the 2000 NPT Conference. Few of these steps have been implemented; even the CTBT, completed in 1996, has not received sufficient ratifications to enter into force. The fissile materials cut-off negotiations have been blocked for a decade. Instead of further progress, we have seen many setbacks. If the whole disarmament process depends on the next incremental step, it can easily be stalemated. Particular steps may encounter resistance from those states who feel that it has placed them at a disadvantage, where their interests have not been considered and balanced in a wider context.

The opposite strategy is to define a given time-bound framework for the elimination of all nuclear weapons before the individual steps and their combined implementation are negotiated — an approach that has been supported by G77 states. Fixing a time-bound framework for the disarmament process as a precondition for negotiations may be problematic, since the timing would be subject to negotiations. It would be better to handle goals and actions in a joint framework.

Why a Nuclear Weapons Convention?

A Nuclear Weapons Convention would include measures for both nuclear non-proliferation and disarmament, and
thus would overcome the division between the camps that Annan criticized. The NWC would specify the comprehensive goal for a world without nuclear weapons and the means of its achievement by concrete measures and steps. It defines a legal framework for a ban and elimination of all nuclear weapons, the control of the nuclear complex and fissile materials, and associated verification measures as well as the rights and duties of both States and individuals.

In 1995, the NWC working group of Abolition 2000 set a goal of drafting a model treaty for nuclear disarmament. In collaboration with IALANA, IPPNW, and INESAP\textsuperscript{16}, the Lawyers Committee on Nuclear Policy established a committee in 1996 which produced a draft document at meetings in New York und Darmstadt, Germany. The model Nuclear Weapons Convention (mNWC) was presented to the public at the NPT Preparatory Committee meeting (PrepCom) in April 1997, and in the same year was submitted by Costa Rica to the United Nations as an official document.\textsuperscript{17} The full text is included in the 1999 book \textit{Security and Survival},\textsuperscript{18} which explains the arguments for the NWC and discusses critical questions on various crucial topics (verification, enforcement, international security, alternatives to nuclear deterrence, terrorism, health and environmental problems, nuclear power, nuclear knowledge, irreversibility, conversion, research and development).\textsuperscript{19} At the NPT PrepCom in May 2007 and as part of the launch of the International Campaign for the Abolition of Nuclear Weapons (ICAN), an extended and updated version of the mNWC and the book \textit{Securing Our Survival} were presented by IALANA, IPPNW and INESAP.\textsuperscript{20} The final document of the NPT conference referred to the NWC,\textsuperscript{21} and Costa Rica and Malaysia submitted the revised mNWC as a UN document at the end of the year.\textsuperscript{22}

The model NWC has been received positively by many governments and non-governmental organizations. The majority of States are ready to start negotiations on the NWC. In December 2006 at the UN General Assembly, 125 States, including the nuclear-weapons states China, India, and Pakistan, called for “commencing multilateral negotiations leading to an early conclusion of a nuclear weapons convention prohibiting the development, production, testing, deployment, stockpiling, transfer, threat or use of nuclear weapons and providing for their elimination.”\textsuperscript{23} Further support comes from the Australian Senate, New Zealand’s Parliament, and the European Parliament, which adopted several resolutions for the elimination of nuclear weapons and in support of the NWC. Recent initiatives were undertaken in the British House of Commons and in the US Congress.\textsuperscript{24}

A main purpose of the model NWC is to show that the abolition of nuclear weapons is possible and practically feasible. The successful ban on anti-personnel land mines in 1997 could be a possible model for nuclear weapons. A complete ban has more public appeal than the limitation of certain forms of weapons or their use, which would have to be distinguished and verified. The model NWC is intended to promote a comprehensive solution to the nuclear risks of our times and to encourage public debate. The revised version addresses changing political conditions, e.g. by assessing the problem of nuclear terrorism and the renaissance of nuclear power. Different views should not be reason not to start the negotiation process; rather, that process offers the opportunity and a forum to express and talk about differences. Although the security landscape is not encouraging today, the NWC can serve as a catalyst to facilitate the transformation to a nuclear-weapon-free world.

Can a NWC be Verified?

The NWC would have the goals of permanently eliminating the world’s existing nuclear arsenals, of preventing the production of new nuclear weapons, and of establishing high barriers to the diversion of nuclear weapons materials. The illegal acquisition of nuclear weapons is to be prevented or at least detected with sufficient reliability. A wide variety of objects and activities is to be monitored, from research, development, and testing of single components to the removal and elimination of complete nuclear weapons, delivery systems, and materials. Some of the activities are easily detectable (such as nuclear explosions), others require considerable verification efforts (such as the search for hidden warheads). The risks of uncertainties increase with declining warhead numbers, because then clandestine nuclear weapons activities have a higher significance. On the other hand, in a nuclear-weapon-free world the acquisition of nuclear weapons would be easier to detect because there is no existing infrastructure that can be used to hide these activities.

The abolition of nuclear weapons can succeed if the disarmament process is transparent and strengthens the trust between the parties. Efficient verification measures are important to detect clandestine activities related to nuclear weapons with sufficient reliability. A variety of measures and methods of verification can be used: remote sensing in the visible, infrared, and radar part of the electromagnetic spectrum; seismic, radiological, hydroacoustic, and infrasound detectors; onsite sensors; and cooperative verification, including information exchange, inspections, preventive controls, and joint overflights.\textsuperscript{25}

The development, testing and deployment of nuclear weapons is a tremendous effort that leaves many detect-
able traces in the environment. The production of nuclear weapons materials requires large facilities, such as reactors and enrichment facilities, which are difficult to hide. Even if they release only tiny amounts of decay products, these are potentially detectable with sensitive sensors and provide hints about their source. So-called nuclear archeology helps to reconstruct a sufficiently accurate picture of previous nuclear activities. Social verification, confidence-building measures and institutional mechanisms (such as international agencies, consultations, and conflict resolution procedures) aim at strengthening the societal context of verification.

The model NWC would put all nuclear weapon materials under comprehensive preventive controls, which would not only monitor diversion of significant amounts of materials but also would reduce or block the access to these materials. To achieve this goal, it is essential to go beyond the existing International Atomic Energy Agency (IAEA), safeguards measures, which are designed to improve the accounting, containment and surveillance of nuclear materials. An international registry and surveillance system could include non-destructive methods of onsite detection and sensors for detecting radionuclides in the environment (e.g. krypton-85). While baseline inspections provide information about the basic inventory, challenge inspections would provide access to critical facilities at any location and any time. Special techniques such as tagging have been developed to uniquely identify treaty-limited items. Some of these methods are already available, others require additional research and development, and may be available when a Nuclear Weapons Convention enters into force.26

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Jürgen Scheffran is Senior Research Scientist with the Program in Arms Control, Disarmament and International Security (ACDIS) at the University of Illinois at Urbana-Champaign, USA. He is teaching on energy and international security as an Adjunct Associate Professor in political science and atmospheric sciences. Currently, he coordinates a project on renewable energy; scheffra@uiuc.edu.

US Leadership for a Nuclear Weapons-Free World

An Appeal to the Next President of the United States

Nuclear weapons could destroy civilization and end intelligent life on the planet. The only sure way to prevent nuclear proliferation, nuclear terrorism and nuclear war – before the next blinding flash – is to rid the world of nuclear weapons.

The era of nuclear weapons must be brought to an end. This can be done. It will require leadership and commitment. Nuclear weapons were created by humans, and it is our responsibility to eliminate them before they eliminate us.

The United States, as the world’s most militarily powerful nation, must take the initiative in convening and leading the nations of the world to urgently take the following steps:

- **De-alert.** Remove all nuclear weapons from high-alert status, separating warheads from delivery vehicles;
- **No First Use.** Make legally binding commitments to No First Use of nuclear weapons and establish nuclear policies consistent with this commitment;
- **No New Nuclear Weapons.** Initiate a moratorium on the research and development of new nuclear weapons, such as the Reliable Replacement Warhead;
- **Ban Nuclear Testing Forever.** Ratify and bring into force the Comprehensive Test Ban Treaty;
- **Control Nuclear Material.** Create a verifiable Fissile Material Cut-off Treaty with provisions to bring all weapons-grade nuclear material and the technologies to create such material under strict and effective international control;
- **Nuclear Weapons Convention.** Commence good faith negotiations, as required by the Non-Proliferation Treaty, to achieve a Nuclear Weapons Convention for the phased, verifiable and irreversible elimination of nuclear weapons;
- **Resources for Peace.** Reallocate resources from the tens of billions currently spent on nuclear arms to alleviating poverty, preventing and curing disease, eliminating hunger and expanding educational opportunities throughout the world.

We call upon the next President of the United States to make a world free of nuclear weapons an urgent priority and to assure US leadership to realize this goal.

To sign the appeal, go to www.wagingpeace.org.
Should And Can the FMCT Be Effectively Verified?

HUI ZHANG

A universal fissile material cutoff treaty (FMCT) will be a key building block in nuclear disarmament, nonproliferation, and the prevention of nuclear terrorism. Negotiation of an effectively verifiable FMCT has been pursued for over a decade. At the 2000 Non-Proliferation Treaty (NPT) Review Conference, 13 practical steps for the systematic and progressive implementation of Article VI of the NPT were agreed upon by all States Parties.

One important step emphasized “the necessity of negotiations in the Conference on Disarmament on a non-discriminatory, multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices in accordance with the statement of the Special Coordinator in 1995 and the mandate contained therein, taking into consideration both nuclear disarmament and nuclear non-proliferation objectives. The Conference on Disarmament is urged to agree on a programme of work which includes the immediate commencement of negotiations on such a treaty with a view to their conclusion within five years.”

However, negotiations on the FMCT have been stalled due to competing negotiating priorities at the Conference on Disarmament in Geneva. The Bush Administration announced in July 2004 that although it supported a cutoff treaty and was willing to resume negotiations, it would no longer support such a treaty if it contained verification provisions. In a White Paper issued May 18, 2006, the U.S. argued that “effective verification” of an FMCT cannot be achieved. “The United States has concluded that, even with extensive verification mechanisms and provisions — so extensive that they could compromise the core national security interests of key signatories, and so costly that many countries would be hesitant to implement them — we still would not have high confidence in our ability to monitor compliance with an FMCT.” The new US position insisting on an unverified FMCT runs counter to an effort at the Conference on Disarmament to conclude an effectively verifiable FMCT. It is necessary to examine whether the U.S. new position makes sense.

Why Should the FMCT Need an International Verification Regime?

A primary goal of an FMCT will be to attain the signatures of the five NPT nuclear weapon states and three non-NPT countries – India, Pakistan, and Israel (hereafter referred to as eight target states). Ending North Korean production of fissile material would depend on the negotiation of North Korean denuclearization. While all five NPT nuclear weapon states have stopped production of nuclear materials for weapons, India, Pakistan, and Israel are believed still to be producing fissile material for weapons use. Thus, one focus of any useful FMCT must be the participation of the three non-NPT countries.

Without FMCT verification provisions and an international verification mechanism, can the international community have confidence that the target states indeed have ended the production of fissile materials for weapons? While the new US position would not support an FMCT with international verification provisions, it wants to verify an FMCT by “national means and methods.” This new verification approach of national means and methods, which would replace the old term “national technical means” (NTM) in the current US Administration’s approach, would allow nations to apply information not only from the NTM, but also information obtained from commercial satellite imaging and other open sources. One question is whether this new verification approach alone can provide confidence in treaty compliance in the absence of an on-site verification mechanism.

To examine this question, I will focus on the three non-NPT countries. Under an FMCT, international society would want to assure that all known major nuclear facilities in the three non-NPT countries (as listed in Table 1 and 2) would cease production of fissile material for weapons purposes. For example, military reprocessing facilities used in weapons programs in Israel, Pakistan, and India would be expected to be closed or used for some purpose other than plutonium production. The most effective measures to demonstrate their shutdown status are site environmental monitoring and on-site visits. In practice, on-site inspection has played an essential and effective role in detecting undeclared nuclear facilities and activities, as already shown in the case of North Korea. Satellite imaging would have little role in monitoring these smaller reprocessing facilities, although it could play a complementary role in monitoring the shutdown status of large reprocessing plants, such as those in the US or Russia. Moreover, Pakistan’s centrifuge enrichment
<table>
<thead>
<tr>
<th>Country</th>
<th>Facilities</th>
<th>Status</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>Reprocessing plants (F &amp; H reprocessing areas) at Savannah River Site</td>
<td>Military/S</td>
<td>Expected to be closed under an FMCT.</td>
</tr>
<tr>
<td></td>
<td>Reprocessing plants at Idaho National Engineering Lab and Hanford Reservation</td>
<td>Military/S</td>
<td>All those military reprocessing plants would be closed. Pilot facilities planned for civilian applications.</td>
</tr>
<tr>
<td>Russia</td>
<td>TR-1 reprocessing at Ozersk</td>
<td>Civilian/OP</td>
<td>Could be in operation after an FMCT.</td>
</tr>
<tr>
<td></td>
<td>TR-2 reprocessing at Zheleznogorsk</td>
<td>Military/Deferred</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 reprocessing plants at Seversk and Zheleznogorsk</td>
<td>Military/OP</td>
<td>Reprocessing spent fuel from 3 production reactors for heating. To be shutdown.</td>
</tr>
<tr>
<td>U.K.</td>
<td>The reprocessing plant at Dounreay and B204 at Sellafield</td>
<td>Military/S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B205 reprocessing plant &amp; THORP at Sellafield</td>
<td>Civilian/OP</td>
<td>EURATOM safeguards. Planned to be shutdown in next several years.</td>
</tr>
<tr>
<td>France</td>
<td>UPI reprocessing plant at Marcoule</td>
<td>Military/S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UP-2 &amp; UP-3 reprocessing plants at La Hague</td>
<td>Civilian/OP</td>
<td>EURATOM safeguards.</td>
</tr>
<tr>
<td>China</td>
<td>2 reprocessing plants at Jiuquan &amp; Guangyuan nuclear complex</td>
<td>Military/S</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>Trombay reprocessing plant</td>
<td>Military/OP</td>
<td>Expected to be closed after FMCT.</td>
</tr>
<tr>
<td></td>
<td>Reprocessing plants at Tarapur &amp; Kalpakkam</td>
<td>Dual?/OP</td>
<td>Tarapur reprocessing safeguarded when reprocessing IAEA safeguarded spent fuel.</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Nilore reprocessing plant</td>
<td>Military/OP</td>
<td>Expected to be closed after FMCT.</td>
</tr>
<tr>
<td>Israel</td>
<td>Dimona reprocessing plant</td>
<td>Military/OP</td>
<td>Expected to be closed after FMCT.</td>
</tr>
</tbody>
</table>

Table 1: Major reprocessing facilities affected by an FMCT

<table>
<thead>
<tr>
<th>Country</th>
<th>Facilities</th>
<th>Status</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>2 GDPs at K-25 &amp; Portsmouth</td>
<td>Military/S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GDP at Paducah</td>
<td>Civilian/OP</td>
<td>Expected to be replaced by two planned CEPs (IAEA).</td>
</tr>
<tr>
<td></td>
<td>2 CEPs at Ohio and NM</td>
<td>Civilian/Planned</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>4 CEPs at Angarsk; Seversk, Krasnoyarsk and Sverdlovsk-44</td>
<td>Civilian/OP</td>
<td>Expected to be in operation after an FMCT.</td>
</tr>
<tr>
<td>U.K.</td>
<td>GDP at Capenhurst</td>
<td>Military/S</td>
<td>IAEA.</td>
</tr>
<tr>
<td>France</td>
<td>GDP at Pierrelatte</td>
<td>Military/S</td>
<td>EURATOM. To be replaced by the being-built CEP at the site (IAEA).</td>
</tr>
<tr>
<td></td>
<td>GDP at Georges Besse</td>
<td>Civilian/OP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CEP at Georges Besse II</td>
<td>Civilian/Planned</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>2 GDPs at Lanzhou and Heping</td>
<td>Military/S</td>
<td>After ending HEU production, both produced LEU for civilian. Lanzhou GDP decommissioned in 1999.</td>
</tr>
<tr>
<td></td>
<td>2 CEPs at Hanzhong and Lanzhou</td>
<td>Civilian/OP</td>
<td>Both in operational; Hanzhong under IAEA.</td>
</tr>
<tr>
<td>India</td>
<td>Rattehalli CEP</td>
<td>Military/OP</td>
<td>After FMCT, could it continue to operate for naval fuel?</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Kahuta CEP</td>
<td>Military/OP</td>
<td>Expected to be closed after FMCT.</td>
</tr>
</tbody>
</table>

Table 2: Major enrichment facilities affected by an FMCT
plant (CEP) at Kahuta would be expected to be shut down after an FMCT. There would also be a need to monitor the Indian CEP at Rattehalli. The most effective measures to monitor these smaller-scale CEPs (whether shutdown or operating for non-weapon purposes) are on-site inspections. While satellite imaging could play an important role in monitoring the shutdown status of the gaseous-diffusion plants (GDPs) in the five NPT nuclear weapon states, these CEPs will have much less obviously observable characteristics than a GDP has for satellite imagery.

In addition, while satellite imagery would be useful for detecting undeclared nuclear facilities and confirming information acquired from other sources, it is not sufficient for a final determination concerning activities at the facilities. On-site inspection is necessary to resolve any disputes. Finally, if those facilities that were used for nuclear weapons programs continue operating for civilian purposes, satellite imagery would be less useful, because it would be difficult to distinguish between different operating modes (whether for weapons or non-weapons production) of operating facilities. Monitoring these declared operating nuclear facilities would require many on-site inspections, as is the case in implementing safeguards of the International Atomic Energy Agency (IAEA).

Thus, an international verification regime (especially including on-site verifications) would be essential to building confidence in the effectiveness of an FMCT. Moreover, without an international verification regime, some nations would be concerned about abuse of “national means and methods.” For example, some nations may be concerned about the equality of national means. They may be concerned that one nation could use shutter-control policies to limit the delivery of commercial satellite images. Related to this is the question of whether a country will allow its commercial imaging firms to deliver satellite images to a rival during a crisis or war. There also is a potential concern that a nation could enter into an exclusive arrangement with the operator of a commercial satellite to buy all images of sensitive sites and thus to deny those images to other organizations. Consequently, it can be expected that there would be countless compliance disputes in the absence of a negotiated arrangement to resolve them.

Can the FMCT Be Effectively Verified?

The verification objective of an FMCT – to ensure that no fissile material is being produced for weapons – is similar to IAEA safeguards for the NPT non-nuclear-weapon states. Thus FMCT verification provisions can be developed based on an IAEA approach that already has accumulated extensive experience in over 40 years of safeguarding nuclear materials and activities. Based on the IAEA safeguards experience, experts have proposed many verification approaches ranging from focused to comprehensive verification schemes. Focused verification would concentrate only on sensitive fissile material production facilities, i.e., reprocessing and enrichment facilities, and on fissile materials produced after an FMCT enters into force, along with the facilities where these materials are present. A wide-scope approach would cover a variety of additional less sensitive civilian facilities, such as fuel fabrication plants and civilian power reactors. It is believed that a focused approach is technically adequate and cost-effective for the FMCT.

After the FMCT enters into force, its verification would focus, in the first instance, on declared former military fissile material production facilities (e.g., uranium-enrichment and reprocessing plants). Many of these production facilities would be shut down (as shown in Table 1 and 2). To provide assurance that no operations are carried out in these closed plants, verification activities will include on-site inspections, the use of seals, surveillance or monitors on critical plant equipment, environmental sampling, and remote sensing. As examples, Table 3 and 4 show some measures that could be applied to verify the shutdown status of a reprocessing plant or a GDP.

Figure 1 shows a Landsat-5 thermal infrared image of the Portsmouth GDP taken March 12, 1994. The hot roofs of the process buildings X-333, X-330, and X-326 are clearly visible. It can be expected that if GDPs are operating, the thermal signatures (e.g. warm cooling tower vapor plumes and the hot roofs of the process building) would be detectable using the thermal infrared images of a commercial satellite. In short, it should be easy to monitor the status of these closed facilities. Some would continue operating for non-weapons purposes. The verification measures necessary for these declared operating facilities would be primarily IAEA-type safeguards.

While the detection of undeclared nuclear facilities would be a challenge, a number of new measures being applied or developed for strengthening IAEA safeguards would make a clandestine nuclear program more difficult. These measures for FMCT verification would include: satellite imagery; information collection and analysis; on-site visits; and environmental sampling as envisioned by the Additional Protocol.

For example, the key fissile material production facilities would have some visible infrastructure signatures for high-resolution satellite imagery (see Table 5). In the absence of elaborate concealment measures, all these characteristic visible features would be detected and identified using high-resolution satellite images. In addition, construction activities for all these types of nuclear facilities
could be detected by satellite imaging. However, smaller-scale technologies such as gas centrifuge facilities - which could be a preferred approach for future proliferants - will have much less obviously observable characteristics. The identification of a CEP has to rely heavily on other collateral information. Once the satellite imagery detects the undeclared facilities and activities, it could provide the targets for on-site inspections. It could trigger a special inspection with on-site sampling and visual observation. More importantly, more intrusive measures including complementary access and environmental sampling, as provided for in the Additional Protocol, should be applied to detect and identify undeclared facilities and activities. Moreover, non-governmental organizations, individuals, and government intelligence agencies could also uncover a secret nuclear program, as shown in the unveiling of Israel’s Dimona complex. Furthermore, the verification provision itself would play a deterrent role. From the beginning, FMCT verification should be designed to detect and deter noncompliance.

It should be noted that even the detection of a small-scale CEP is a challenge using IAEA safeguards, and such a facility might be small enough to evade FMCT verification. Indeed, a smaller CEP could be easily hidden. And such a small covert CEP (say producing enough HEU for a few bombs per year) would have great strategic significance for a non-nuclear-weapon state, as its status would be changed to that of a nuclear-weapon state. However, such a small, covert CEP could not have great strategic significance for the eight target nuclear states, which already possess significant nuclear stockpiles. Thus, the net risk to world security from the possibility of covert plants in the eight target states is far less than the net gain for world security from verified shut-down of the known production facilities in those states.

Could FMCT Verification Compromise the Core Security Interests of Key Signatories?

Another major question is whether an effective FMCT verification regime could be established while protecting national security secrets. For example, to monitor the shutdown status of a reprocessing plant, one effective verification means would be site environmental sampling. Some target states may worry that on-site sampling and visual observation: e.g.

<table>
<thead>
<tr>
<th>On-site verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site visual observation, e.g.:</td>
</tr>
<tr>
<td>• outside the cascade building:</td>
</tr>
<tr>
<td>- no plume from the cooling towers</td>
</tr>
<tr>
<td>- no treatment of cooling water, etc.</td>
</tr>
<tr>
<td>• inside the building:</td>
</tr>
<tr>
<td>- not hot, not noisy</td>
</tr>
<tr>
<td>Continuous surveillance monitor and tamper-proof seal: e.g.:</td>
</tr>
<tr>
<td>• seal the high-voltage disconnect switches</td>
</tr>
<tr>
<td>• seal the valves on the supply and return headers of the Recirculating Cooling Water system</td>
</tr>
<tr>
<td>• seal the inlet and outlet block valves for the cascade piping</td>
</tr>
<tr>
<td>• put vibration and/or temperature sensors on the process equipment</td>
</tr>
</tbody>
</table>

Table 4: Verifying the shutdown status of a gaseous diffusion plant

---

Table 3: Verifying the shutdown status of a reprocessing plant

<table>
<thead>
<tr>
<th>Off-site verification</th>
<th>On-site verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental sampling, e.g.</td>
<td></td>
</tr>
<tr>
<td>• glove box</td>
<td></td>
</tr>
<tr>
<td>• High-level waste tanks</td>
<td></td>
</tr>
<tr>
<td>Visual observation: e.g.</td>
<td></td>
</tr>
<tr>
<td>• no activity at the railroad cask portal, etc.</td>
<td></td>
</tr>
<tr>
<td>Continuous surveillance monitor and tamper-proof seal, e.g.</td>
<td></td>
</tr>
<tr>
<td>• outside the canyon building: monitoring the waste stream, etc.</td>
<td></td>
</tr>
<tr>
<td>Satellite remote sensing such as</td>
<td></td>
</tr>
<tr>
<td>• VNIR: activity level</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Verifying the shutdown status of a gaseous diffusion plant

---

Figure 1: Landsat-5 thermal infrared picture of Portsmouth gaseous-diffusion plant taken March 12, 1994

Figure 1: Landsat-5 thermal infrared picture of Portsmouth gaseous-diffusion plant taken March 12, 1994
Table 5: Infrastructure features of dedicated nuclear material production facilities that might be observable from high resolution satellite imagery

<table>
<thead>
<tr>
<th>Nuclear facilities</th>
<th>Observable characteristic features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactors</td>
<td>Cooling towers or a natural water body (with intake and discharge port); a high narrow stack (or its shadow); a reactor building; security perimeter; railroads, roads; an isolated site, etc.</td>
</tr>
<tr>
<td>Reprocessing plants</td>
<td>A very high stack (or its shadow); a long “canyon-like” building (or with vent); some holding ponds or reservoirs for waste or sludge; security perimeter; railroads, roads; an isolated site, etc.</td>
</tr>
<tr>
<td>Gaseous-diffusion plants</td>
<td>Large-area (roof) process buildings (the roof of most buildings have ventilation shafts); cooling towers or a nearby river or lakes; a nearby fossil fuel power plant; large electric switchyard (substation); waste management and disposal facilities; security perimeter; railroads, roads; an isolated site, etc.</td>
</tr>
</tbody>
</table>

sis could disclose sensitive information about their past plutonium production activities, such as the power level at which production reactors had operated and how much plutonium they had produced, data that will probably not have to be declared under an FMCT. Thus, it is necessary to consider whether sampling activities also could reveal the quantity of plutonium produced prior to the FMCT. We have found, however, that sampling analysis at reprocessing plants need not reveal sensitive information relating to past plutonium production at former military plutonium production facilities.\(^8\)

The issues of collocated facilities could be a major challenge to FMCT verification. For example, under an FMCT, the eight target states legitimately would retain some sensitive nuclear processing facilities and activities (e.g. for nuclear weapon assembly/disassembly and weapons material recycling) and nuclear materials (from pre-stocks), which could be co-located with declared or suspected facilities (such as reprocessing and enrichment plants) requiring verification. Thus, some nuclear states could worry about potential loss of sensitive information at those defense-related nuclear processing sites. For such cases, a managed access approach, as in the Chemical Weapons Convention, will be vital to FMCT verification. For most managed access situations, simple procedures are sufficient. Consequently, it is believed that an effective FMCT verification regime should be able to be established while protecting national security secrets. In fact, a U.S. State Department official suggested, in presenting an earlier U.S. government position on FMCT verification at the 1999 Carnegie International Non-Proliferation Conference, “We think that a strong regime of routine monitoring of all [fissile] production facilities and all newly produced material and a regime for nonroutine or so-called challenge inspections would give us enough building blocks to build an effective verification regime.”\(^9\)

Finally, is FMCT verification too expensive? As an example, we consider the case of a focused approach, which would be most likely to be acceptable to the target nuclear states. It is estimated that implementing this focused approach in the eight target states would cost about US$ 80-130 million annually (in 2004 dollars).\(^10\) Compared to its security benefits, however, such a cost would be modest. An effective FMCT would make an important contribution to nuclear disarmament, the non-proliferation regime, and the prevention of nuclear terrorism. However, a credible verification regime would be vital to an effective FMCT.

In conclusion, an effective and meaningful FMCT must have a credible verification regime. It should be technically feasible to establish an effectively verifiable FMCT at a reasonable cost, while protecting national security secrets.

**References**

4. Ibid.
Detecting Atmospheric UF$_6$ and HF as Indicators for Uranium Enrichment

JENS BÖSENBERG AND MARTIN B. KALINOWSKI

Clandestine plutonium production can be detected at a distance of 100 km and beyond by atmospheric krypton-85 plumes. By contrast, it is much more challenging to measure a tracer that indicates unreported production of highly enriched uranium (HEU). It has not yet been proven that this is feasible, but many experts are confident that LIDAR (Light Detection And Ranging) could be used by IAEA (International Atomic Energy Agency) inspectors to detect UF$_6$ (uranium hexafluoride) or HF (hydrofluoric acid) discharged into the atmosphere. Research projects have been funded to develop and test the required equipment. But there is severe doubt as to whether signatures are strong enough and measurement sensitivities low enough to make off-site detection possible. This paper compares realistic estimates of the source terms and the theoretically achievable sensitivities of DIAL (Differential Absorption Lidar) for UF$_6$ and HF.

Atmospheric Releases from Uranium Enrichment Plants

Whenever estimates are used for uranium releases from an unreported enrichment plant, they refer back to the same study of Albright & Barbour (1997). That paper still remains the only extensive investigation on this topic. It is based on publicly available reports on historic releases from US enrichment plants. Table 1 presents the summary of that study for a reference facility that is defined by the annual production capacity of 25 kg HEU. That is one significant quantity or material for one weapon per year.

<table>
<thead>
<tr>
<th>Estimated uranium releases from reference facilities (kg/y)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of facility</strong></td>
</tr>
<tr>
<td>UF$_6$ production (conversion)</td>
</tr>
<tr>
<td>Gaseous diffusion$^1$</td>
</tr>
<tr>
<td>Gas centrifuge</td>
</tr>
<tr>
<td>EMIS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Central estimate of enriched uranium releases (kg/y)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of facility</strong></td>
</tr>
<tr>
<td>Gaseous diffusion</td>
</tr>
<tr>
<td>Gas centrifuge</td>
</tr>
<tr>
<td>EMIS</td>
</tr>
</tbody>
</table>

Table 1: Estimate of uranium releases from a reference facility$^1$

Figure 1 shows the timeline of annual uranium releases from a diffusion type enrichment plant. Fairly high releases occurred in the first twenty years of its operation while the facility was comparatively clean in the follow-
ing twenty years. Technical progress has resulted in much lower emissions. If a country has just mastered the enrichment technology, the uranium release probably provide a much better signature than later in the development cycle when the operator has had a chance to reduce emissions.

Figure 2 shows the historic releases of the German centrifuge type uranium enrichment plant at Gronau, which is operated by Urenco. The first important observation is that the activity release rate remained almost constant over two decades while the production rate increased almost linearly. The license emission limit for alpha activity is 5.2 MBq/a. The actual emissions reached a typical fraction of 1% of the limit, some 50 kBq/a. According to Urenco, 95% of the total alpha activity release consists of radon decay products. With a conversion factor of 25.3 kBq/g U-nat (0.568 kBq/g U-235), the estimated annual release rate is 0.1 g/a of uranium with natural abundance. The Urenco safety report is based on conservative assumptions, namely a mass release rate of 85 g/a. The annual release is caused solely by normal operation conditions, i.e. no accidental releases has occurred at the Gronau facility since 1985. The experience made at Gronau allows two conclusions: first, emissions from a large-scale uranium enrichment plant can be kept very low; second, inspectors can neither hope for an increased signal due to accidental release nor rely on a strong variability of the operational release levels.

It is of interest to compare the Gronau facility with the Urenco enrichment plant at Capenhurst. The alpha activity release of that facility is reported to be 0.60 MBq in 2002, 0.74 MBq 2003 and 0.57 MBq in 2004. This shows that the Capenhurst emissions are more than ten times larger than those at Gronau. Obviously, significant differences can be found between individual plants of similar design. This reinforces the conclusion that no general principles can be found to predict the uranium emissions of enrichment plants.

Releases of Gaseous Tracers UF₆ and HF
Gaseous emissions from an uranium enrichment plant could be either UF₆ or HF. Below, the possible densities of these trace gases at the exhaust stack shall be assessed.

The uranium enrichment plant operates on the gaseous uranium compound UF₆. In humid air, this molecule reacts with water according to the chemical equation

\[ UF_6 + 2 H_2O \rightarrow UF_2O_2 + 4 HF \]

Since this is a fast reaction, it is likely that UF₆ is removed either inside the building or very soon after emission. If this is true, the only reliable indicators for remote detection of a uranium enrichment plant could be UF₂O₂ (uranyl fluoride) and HF.

UF₂O₂ is particle-bound and can probably be detected only in air filters. UF₂O₂ could possibly be identified with Lidar based on Raman scattering.

HF can very effectively be contained by filters in the stack. As a result, HF above the detection limit (0.02 mg/m³) has never been observed in the stack exhaust of the Gronau plant. The conservative assumption in the Gronau security report for the emission rate is 320 g HF per year.

In view to these data, the annual emission rate of UF₆ is likely between 0.1 and 10 g/a. It would be very optimistic from the perspective of an inspectorate to assume a total emission of 100 g UF₆ per year. A typical total volume rate of a single exhaust is 104 m³/h. This results in a particle density at the stack of

\[ n(UF_6) = 2.8 \times 10^{15} \text{ m}^{-3} \]

i.e. Mass ratio of 1x10⁻¹⁰

When further assuming the total conversion of UF₆ to UF₂O₂ and HF, the molecular density would be

\[ n(HF) = 1.1 \times 10^{16} \text{ m}^{-3} \]

i.e. Mass ratio of 4.2x10⁻¹⁰

Figure 1: Estimated annual uranium release to air from the uranium enrichment plant at Oak Ridge, Tennessee, USA²
Reduction of Concentrations During Atmospheric Transport

During atmospheric transport away from the source, the plume undergoes dilution, and the concentration of the tracer is eventually reduced towards background levels. With a source term for a uranium enrichment plant as stated above, the trace gas concentrations at a distance of hundreds of kilometers can be estimated. Atmospheric transport simulations have shown that after 24 hours transport, the plume concentrations are highly variable. Typically, 90% of the plume is characterized by a dilution in the range of $10^{12}$-$10^{14}$. This part of the plume extends to $\sim 104$ km$^2$, and after one day the plume centre has located 100-500 km from the source.

Assuming a total emission of 100 g UF$_6$ per year, this translates into continuous emission of 0.27 g per day or 0.07 g per six hours interval. If the release from six hours forms a plume with a dilution volume of 1012 m$^3$, the concentration of UF$_6$ will be

$$n(\text{UF}_6) = 0.2 \text{ m}^{-3}$$

If the UF$_6$ is completely converted to UF$_2$O$_2$ and HF, the molecule concentration is

$$n(\text{HF}) = 0.8 \text{ m}^{-3}$$

For any realistic scenarios, the chemical instability of HF must also be factored in. Further, any other possible industrial sources of HF have to be taken into account. Accordingly, the derived concentration estimate is very optimistic.

Summary on Releases from Enrichment

The assessment of indicator releases from uranium enrichment plants can be summarized as follows: the gaseous indicators are UF$_6$ and HF. While UF$_6$ is converted prior to release or within minutes after the release, HF is more likely to be found in the exhaust air of a uranium enrichment plant. However, HF is also known to be chemically unstable. In addition, it should be taken into account that there are plenty of other industrial sources for HF.

Any particle-bound chemical compound that contains both uranium and fluorine would be a perfect indicator for enrichment activities because there are no natural or other anthropogenic sources for this combination. The most likely compound that is emitted from enrichment facilities and that contains uranium and fluorine is uranyl fluoride (UF$_2$O$_2$). In view of the above discussion, UF$_2$O$_2$ must be considered the only reliable signature for enrichment plants. Even then, it is to be expected that detectable concentrations occur only close to the release point. Enriched uranium could also be a highly selective indicator for an enrichment plant. However, it has never been detected in any by-pass filter samples taken at the Gronau enrichment facility in the past two decades.

Remote Sensing of Gases from Enrichment

Remote detection of trace gases in the atmosphere is best done by using spectroscopic techniques based on the specific absorption characteristics of each molecule. Active remote sensing is preferred in order to ensure that the method is as sensitive and independent from external light sources as possible, and lasers are suitable because of their excellent spectral properties. The best choice for remote trace gas detection is the Differential Absorption
Lidar (DIAL) method, and its basic properties will be explained in the following.

DIAL is a special application of the lidar technique, where lidar stands for light detection and ranging in analogy to the well-known radar technique. It works in a very similar way, namely by transmitting short pulses of electromagnetic radiation (light) into the atmosphere and analyzing the backscattered light that is collected in a receiving telescope. The data thus gained includes range information that is acquired by measuring the time it takes the light pulse to travel from the transmitter to the scattering volume and back to the receiver. This is shown in Figure 1. The received power is described by the so-called lidar equation

\[ P(R) \cdot R^2 = C \cdot \beta(R) \cdot \exp(-2 \cdot \int_0^R \alpha(r) \, dr) \]  

(1)

where \( P(R) \) is the received power from range \( R \); \( C \) is an instrument constant; \( \beta(R) \) is the total backscatter coefficient at range \( R \); and \( \alpha(r) \) is the total extinction coefficient, including extinction by scattering and absorption. Backscatter in the lower part of the atmosphere originates from both molecular scattering by the air molecules and particle scattering from omnipresent aerosols. Therefore a detectable signal can practically always be obtained provided that transmitted power and receiver sensitivity are adequate. However, there is a principal problem with the quantitative evaluation of such lidar returns: Equation (1) contains two unknowns, \( \beta \) and \( \alpha \), but only one measurement \( P \). So additional information is needed to find an unambiguous solution.

DIAL is an elegant way to solve this problem. Here, two measurements are made for two adjacent wavelengths, where one, called “online,” is chosen at the center of an absorption line of the gas under study, while the second wavelength, called “offline,” is chosen in a region of negligible absorption. When the wavelength difference is sufficiently small, the backscatter coefficient is practically the same because backscatter is always a slow function of wavelength. Hence, the ratio of the two signals becomes independent from the unknown backscatter coefficient, and only the difference in absorption remains to be determined. It is then possible to determine the gas concentration \( c_{gas} \) in a given range interval \( \Delta R \) from the so-called DIAL equation, which contains a total of four measured signals, at two ranges and at two wavelengths:

\[ \ln(\frac{P_{on,\,R2} \cdot P_{off,\,R1}}{P_{on,\,R1} \cdot P_{off,\,R2}}) = -2 \cdot (\sigma_{on} - \sigma_{off}) \cdot \Delta R \]

(2)

(\( \sigma_{on} - \sigma_{off} \)) is the differential absorption between on- and offline, and \( \Delta R \) is called differential optical depth \( \Delta \tau \).

The DIAL method is generally applicable to all gases, in particular when they show narrow isolated absorption lines. It is well established in atmospheric research, where it is used for the quantitative retrieval of the vertical distribution of, e.g., ozone, sulfur dioxide, water vapor, or hydrocarbons. Several instruments have been built and operated reliably from various platforms, including small trucks and aircraft. The most accurate measurements were made for water vapor, and a detailed error analysis established a detection limit of \( \Delta \tau_{min} = 0.002 \) for the differential optical depth, provided that high quality components are used in the detection chain and operating conditions are well controlled. With this limit for the detection of the differential optical depth it is easy to derive detection limits for any trace gas concentration when the absorption cross section is known as well as the range interval in which the trace gas is present:

\[ \Delta c_{min} = \Delta \tau_{min} / (\Delta \sigma \cdot \Delta R) \]

where \( \Delta c_{min} \) is the minimum detectable concentration; \( \Delta \sigma \) is the differential absorption cross section of the gas under study; and \( \Delta R \) is the range interval where the gas is present and the DIAL signals can be evaluated.

In summary, with DIAL it is possible to detect practically any gaseous component with high sensitivity, in particular at distances up to several km, from various platforms, and, if required, in an automated way. However, the instrument has to be designed specifically for each application, adapting the laser and detector systems to the most suitable wavelength and to the spectral resolution requirements as well as to the operating conditions. No serious problems are expected because basic building blocks are available and the methodology is well established.

Estimation of the Detection Limits for UF₆ and HF
As explained above, the major gaseous components to look for in the uranium enrichment process are UF₆ and HF. Therefore it is useful to estimate the detection limits for the concentration of these gases in remote sensing with DIAL.

From the literature it appears that the absorption cross section for UF₆ for the strongest useful band is
Δσ = 3 · 10⁻²⁴ m²
From this the minimum detectable number density for UF₆ molecules is estimated as
Δcₘᵟₙ, UF₆ = 7 · 10²⁰ m⁻³

This corresponds to a mixing ratio by volume of about 30 ppmV (parts per million by volume).

Smaller number densities may be detected when a longer path length can be used. This could be achieved by using a path along the plume rather than across the plume. Pathlengths on the order of 100 m to 1,000 m may thus be possible, by which the detection limit could possibly be reduced to
Δcₘᵟₙ, UF₆ = 1.4 · 10¹⁸ m⁻³ or 50 ppbV

For HF the strongest useful absorption lines appear to be in the 2.5 µm spectral region, where an absorption cross section of Δσ HF = 7 · 10⁻²² m² is reported in a region with small interference with other common trace gases. At the stack exit, for a range interval of only 1 m, the minimum detectable concentration is
Δcₘᵟₙ, HF = 3 · 10¹⁸ m⁻³ or 100 ppbV

This corresponds to a mixing ratio of 0.2 ppbV, which demonstrates that DIAL is a very sensitive method for trace gas detection.

Discussion

As explained above, estimations of UF₆ or HF concentrations during normal operation and during accidental releases cover a very broad range. For UF₆ it is rather unlikely that releases at enrichment plants exceed the detection limit of remote sensing with Differential Absorption Lidar. For well operated, clean establishments UF₆ emissions are apparently at least three orders of magnitude below the detection limit of lidar, but “dirty” enrichment plants and conversion plants that produce this gas may emit sufficient UF₆ to be detectable in plumes close to the release point.

Considering the short lifetime of UF₆ in the atmosphere, it is more promising to look for the chemical reaction product HF, although this is less specific as an indicator of undeclared enrichment activities. However, for HF the sensitivity of DIAL is much better because stronger absorption lines can be used, so that the low levels originating from UF₆ emissions under normal operating conditions, estimated as about 1 ppbV, may be detectable.

The question whether or not remote sensing of trace gases used in enrichment plants is feasible can ultimately be answered once field measurements have been conducted under realistic conditions, i.e. by making concentration measurements for UF₆ and HF in the vicinity of clean and, if possible, also “dirty” enrichment plants.

References

2 Because of uncertainties about the minimum size of a gaseous diffusion plant able to produce weapon-grade uranium and the magnitude of uranium releases in such a facility, these release estimates were derived for a plant with an annual output of 20,000 SWU/yr, which is enough to make 125 kg of weapon-grade uranium per year.
3 David Albright and Lauren Barbour, op.cit.

At the time of writing, JENS BÖSENBERG was head of the Laser Remote Sensing Group at the Max-Planck-Institut für Meteorologie in Hamburg, Germany; boesenberg@dkrz.de.

MARTIN B. KALINOWSKI is Carl Friedrich von Weizsäcker Professor for Science and Peace Research at the University of Hamburg and chair of the Independent Group of Scientific Experts; martin.kalinowski@uni-hamburg.de.
Almost two decades since the end of the Cold War, the United States and Russia still retain stockpiles of about 10,000 nuclear weapons each and have committed only to reduce to about half that number by the end of 2012, when the Strategic Offensive Reductions Treaty comes into force.

There are now seven other nuclear weapon states, including North Korea, which carried out its first nuclear test on October 9, 2006. Their arsenals range from a few simple warheads to several hundred high-yield thermonuclear weapons.

There are growing concerns about a loss of momentum in the nuclear disarmament process, additional states acquiring nuclear weapons, and the possibility of nuclear terrorism.

Fissile materials, ordinarily plutonium and highly enriched uranium (HEU), are the essential ingredients in all nuclear weapons. Securing, consolidating, and eliminating fissile material stocks worldwide are the common imperatives in the overlapping efforts to eliminate nuclear weapons in the countries where they exist, halt their spread to still more countries, and prevent terrorists from obtaining them.

This is the second report by International Panel on Fissile Materials on the global situation with regard to efforts to secure and eliminate fissile materials. In this year's report:

- **Chapter 1** provides an overview of the status of fissile-material stocks and their production and disposition worldwide;
- **Chapters 2 through 5** describe progress in reducing and consolidating global stocks of nuclear weapons and fissile materials; and
- **Chapters 6 through 9** discuss initiatives aimed at strengthening international controls over fissile materials and the means of their production.

A short Appendix provides an introduction to fissile materials and their use in nuclear weapons.

Below we summarize briefly some of our key findings and conclusions.

**Highly Enriched Uranium**

As of early 2007, the global stockpiles of HEU totaled between 1400 and 2000 metric tons.\(^1\) The uncertainty reflects mostly the fact that Russia has not revealed how much HEU it has made.

During 2006, Russia blended down 30 metric tons of weapon-grade uranium to low-enriched uranium (LEU) and shipped it to the United States. This met about half the fuel requirement of U.S. nuclear power plants. Thus far, almost 300 tons of Russian weapon-grade uranium have been disposed of in this way. This program is expected to continue until 2013, by which time 500 tons of HEU, enough for 20,000 weapons, will have been blended down.

In the United States, a total of 87 tons of excess HEU had been blended down as of mid-2007. None of this HEU was weapon-grade. The United States plans to blend down or otherwise dispose of 147 additional tons of HEU, some from weapons, over the next few decades.

Russia and the United States retain for weapons a combined total of 600 to 1200 tons of HEU – sufficient for 25,000 to 50,000 nuclear warheads.

The United States has set aside almost all its excess weapon-grade uranium for use as naval-reactor fuel – enough for 5,000 more nuclear warheads. Russia and the United Kingdom also have large reserves of HEU for naval fuel. These naval HEU stockpiles, and their vulnerable processing and transport links, would be eliminated if the three countries followed France's example and moved to naval reactors fueled with LEU.

HEU also has been used as a fuel for research reactors worldwide since the 1960s. The United States is leading a global effort to clean out often insecure civilian HEU. Thus far, HEU in both fresh and spent fuel has been completely removed from sixteen countries. Twenty-eight, however, still have enough civilian HEU to make at least one nuclear weapon. Russia, which has half of the world's 140 HEU-fueled research reactors, has no policy with regard to HEU cleanout at home.

**Separated Plutonium**

The current global stockpile of separated plutonium is about 500 tons.

During 2006, Russia and the United States made no progress toward implementing their agreement to each dispose of a minimum of 34 tons of excess weapon-grade plutonium. These programs, launched in 2000, have experienced slipping schedules and rising cost estimates. Russia's intention to use its excess plutonium to fuel a breeder reactor indicates that it expects eventually to separate the plutonium again.
India, Pakistan and probably Israel continue to produce more plutonium for weapons. Both India and Pakistan are expanding their production capabilities but, on 14 July 2007, North Korea shut down its plutonium production reactor – hopefully permanently.

As of 2007, the global stock of civilian plutonium is approximately 250 metric tons – our central estimate of the amount of plutonium that was made for weapons in the Cold War. Stocks of separated plutonium continue to build up at reprocessing plants in India, Japan, Russia and the United Kingdom. About 8 kg of this “reactor-grade” plutonium is sufficient to make a simple nuclear weapon.

The United Kingdom has decided to abandon spent-fuel reprocessing. Like France and Russia, it has lost its foreign reprocessing customers. It now is faced with the challenge of disposing of one third of the world’s separated civilian plutonium and cleaning up the legacy of radioactive contamination from reprocessing, at a cost currently estimated at $75 billion.

Japan has shifted from reprocessing abroad to reprocessing at home. In 2006, it began to operate a new $20 billion domestic spent-fuel reprocessing plant. Operating at design capacity, this plant will separate more than 20 kg of plutonium per day. Japan has not yet been able to begin recycling any of its 40 tons of already separated plutonium into light-water power reactor fuel.

In the United States, the Bush Administration has proposed to reverse a three-decade-old moratorium on domestic reprocessing. This so-called Global Nuclear Energy Partnership initiative is encountering strong opposition in the U.S. Congress, however, and its future is uncertain.

Consolidation of Fissile Materials in the U.S. Nuclear Complex

Following the attacks of 11 September 2001, the U.S. Department of Energy (DOE) raised the security requirements for the hundreds of tons of fissile materials spread over its huge nuclear complex. In fiscal year 2006, it spent over $1 billion on this effort.

To further strengthen security and reduce costs, DOE is beginning to consolidate its fissile materials into a smaller number of sites and buildings. When this effort is complete, four of the DOE’s ten main sites will no longer have weapon quantities of fissile materials. At three others, fissile materials will be consolidated into one or two high-security buildings. Progress is being slowed in some cases by opposition at sites that stand to lose fissile materials and fear for their current missions and budgets.

Consolidation has not yet touched the naval-reactor fuel cycle. Naval-reactor fuel is fabricated in the United States at two private lower-security facilities using HEU shipped from the DOE’s Y-12 Site in Tennessee. All U.S. HEU processing and storage could be consolidated at the Y-12 site, where work is underway on new high-security HEU storage and processing buildings.

Progress Toward Nuclear Disarmament

Nothing would reduce the nuclear threat to civilization and increase the credibility of the nonproliferation regime more than the United States and Russia cutting their weapons and associated fissile-materials stockpiles much more deeply.

There are well-developed proposals for how the United States and Russia could quickly reduce the number of warheads in their nuclear stockpiles to 1000 each. Deeper cuts to about 200 weapons each could be made if other nuclear weapon states joined the arms limitation process. Such deep cuts would make it possible to eliminate most of the global stockpile of weapons HEU and plutonium.

International Monitoring in the Nuclear Weapon States

In the 1990s, the United States, Russia, France and the United Kingdom officially ended their production of plutonium and HEU for weapons and China communicated unofficially that it had joined the moratorium. All enrichment and reprocessing activities in these countries therefore could be subject to international monitoring, as in the non-weapon states.

All five of these NPT nuclear weapon states have made “voluntary offers” of nuclear facilities for International Atomic Energy Agency (IAEA) safeguarding. The United Kingdom and the United States have offered all of their civilian nuclear facilities. France, Russia and China have made more limited offers. Budget constraints have prevented the IAEA from putting more than a few of these nuclear facilities under safeguards.

In France and the United Kingdom, all civilian nuclear facilities, including enrichment and reprocessing plants, are subject to Euratom safeguards. This has established an invaluable precedent for the extension of international safeguards into the civilian sectors of the other weapon states.

If the IAEA mandate were extended to include safeguarding enrichment plants, reprocessing plants, and all civilian fissile materials in the nuclear weapon states, much of the infrastructure for a verified ban on the production of fissile material for weapons (a Fissile Material Cutoff Treaty) would have been established.

The Future of Nuclear Power

Over the past two decades, there has been little growth in installed nuclear energy capacity in most of the world, with the exception of some limited construction in Asia.
Nevertheless, given the cost increases in oil and natural gas, and rising concerns about climate change, many in the nuclear industry hope for a three to four-fold increase in global nuclear capacity by 2050. Nuclear power continues to have very high capital costs, however, and there is a lack of public support for a major expansion.

Whatever the future of nuclear power, it is important to limit the spread of national gas-centrifuge uranium enrichment plants, because they can easily be converted to the production of HEU for weapons. One alternative is to have uranium enrichment take place only in facilities that are multinationally owned and operated.

There is no need for spent-fuel reprocessing plants, national or multinational. Reprocessing and storage or recycling of the recovered plutonium persist only where governments do not allow much less costly and more secure dry-cask storage of spent fuel.

Russia’s Role in the International Nuclear Fuel Cycle

Russia is seeking to consolidate its civilian nuclear activities into a single state-owned company that can compete in the global nuclear market as a supplier of nuclear fuel cycle services and reactors.

Russia owns about half of the world’s uranium enrichment capacity. It is becoming a major international supplier of uranium-enrichment services and recently proposed to build a multinational enrichment plant at Angarsk that will be open to IAEA safeguards. Russia also fabricates fuel for all Soviet and Russian designed nuclear power reactors, as well as for some Western reactors, and is constructing power reactors in the developing world.

Russia’s commercial spent nuclear fuel reprocessing industry, like those of France and the United Kingdom, is losing its foreign customers. Because of domestic opposition to taking other countries’ radioactive waste, Russia now requires that radioactive waste from foreign spent fuel be returned to the countries of origin. As a result, those countries are switching to domestic dry-cask storage of their spent fuel.

Environmental Monitoring to Detect Clandestine Fissile Material Production

As part of the Additional Protocol to their NPT safeguards agreements, non-weapon states agree to allow the IAEA to conduct wide-area environmental monitoring to detect clandestine reprocessing or uranium enrichment. Thus far, however, the IAEA Board has not authorized such monitoring.

Field tests have shown that krypton-85, a gaseous fission product that is released when spent fuel is dissolved, can be detected reliably at distances on the order of one hundred kilometers downwind from small reprocessing plants. It could therefore be feasible to install detectors outside military complexes to confirm non-intrusively that a country is not separating plutonium inside.

It has proven more difficult so far to detect clandestine uranium enrichment programs. It is widely believed that any uranium that might leak from a facility would be quickly diluted in the atmosphere to the point where it could no longer be detected against the background of naturally occurring uranium. Uranium is used in centrifuge enrichment plants in the form of gaseous uranium hexafluoride (UF6), however, and it appears likely that it will remain tagged by fluorine long after its release. It could therefore be distinguishable from natural uranium quite far downwind.

References

1 In this report, the term “tons” denotes metric tons.

This text is the summary of the second report of the International Panel on Fissile Materials (IPFM); www.fissilematerials.org.
Mr. Chairman, distinguished delegates and colleagues,

[...] Our theme today is the concept of good faith embedded in Article VI of the nuclear Non-Proliferation Treaty (NPT) and the universal disarmament obligation unanimously affirmed by the International Court of Justice (ICJ). For most people who are not lawyers, the term “good faith” may sound rather vague and poetic, though its common sense meaning is clear. But it has a long history and a precise meaning in law.

This has been well explained by Judge Christopher Weeramantry, former Vice-President of the ICJ, 2007 winner of the Right Livelihood Award, and President of the International Association of Lawyers Against Nuclear Arms. In 1996 remarks marking the tenth anniversary of the ICJ’s opinion, Judge Weeramantry explained that the “traditions in relation to good faith are to be found in the ancient system of Roman Law, the system of civil law that has grown up from the Roman Law … and all the traditional systems of law.” Further, the concept of good faith is “amplified” in the laws of the world’s major religions, as well as in the laws of indigenous peoples.

Judge Weeramantry identified some of the legal elements of good faith as: correspondence between word and deed; no secret reservations; openness and transparency, with a complete disclosure of material facts; and a readiness to submit one’s actions to external scrutiny. In addition, good faith requires that meaningful steps be taken towards the desired goal, with no backtracking, and within a reasonable time span. Importantly: “Everyone must refrain from taking steps that militate against the goal. For example, one cannot say that one’s goal is disarmament and then take steps to increase one’s armaments in a somewhat but different way.”

Judge Weeramantry emphasized that there must be cooperation among the parties, a continuity of efforts, and an actual method worked out, with a readiness by the parties to keep re-examining their own positions while seriously considering the proposals of others. Referring to the ICJ’s affirmation of the disarmament obligation, he said:

“[The] ultimate authority on international law ... has unanimously placed this verdict upon all the nuclear powers of the world and we have to ask whether all these ingredients of good faith are being honored. If not, why are they not being honored and in what way are they failing in their responsibility?”

More than a decade after the ICJ opinion, both NPT and non-NPT nuclear weapon states are planning and preparing for maintenance of nuclear forces for decades to come. We agree with the Hans Blix-led Weapons of Mass Destruction Commission that a different sort of planning is necessary:

“All states possessing nuclear weapons should commence planning for security without nuclear weapons. They should start preparing for the outlawing of nuclear weapons through joint practical and incremental measures that include definitions, benchmarks and transparency requirements for nuclear disarmament.”

Yet some nuclear weapon states continue to oppose and block nuclear disarmament negotiations in any of the key international fora including the Conference on Disarmament, the General Assembly, and the NPT review process. No multilateral, plurilateral, or significant bilateral negotiations on any aspect of nuclear disarmament are now underway.

Contrary to commitments made at the 1995 and 2000 NPT Review Conferences, the Comprehensive Test Ban Treaty has not been brought into force; over Russian objections, the United States abandoned the Anti-Ballistic Missile Treaty and began deploying elements of a National Missile Defense system; no negotiations have begun on a fissile materials treaty; the principles of verification, transparency, and irreversibility have been abandoned in U.S.-Russian nuclear arms reductions; and large numbers of U.S. and Russian warheads, an estimated 2,654 altogether, remain ready for nearly instantaneous launch.
Nor have the nuclear weapon states reduced the roles of nuclear weapons in their security doctrines as promised in 2000 and in order to reflect the general illegality of the threat or use of nuclear weapons as concluded by the ICJ in its 1996 Advisory Opinion. On the contrary, several have expanded the situations in which use of the weapons might be threatened or carried out.

The viability of the NPT regime is in jeopardy, in large part due to the lack of good faith evidenced by the nuclear weapon states’ disregarding compliance with Article VI. During the May 2007 NPT Preparatory Committee meeting in Vienna, non-governmental organizations presented a comprehensive dossier of evidence to support this view. United States nuclear weapons policy can be characterized as “fewer but newer.” The U.S. is modernizing its existing nuclear arsenal and making plans to replace all of its nuclear warheads, upgrade its delivery systems, and massively reinvest in its nuclear weapons production complex for the next 25 years, as part of its Global Strike capabilities. Russia, while also reducing the overall size of its nuclear stockpile, is developing new land and sea-based forces. France is continuing to design and develop new nuclear weapons systems for deployment through 2040, and has expanded the role of nuclear weapons in its national security policy. The United Kingdom is moving ahead with plans to replace and extend its Trident system until 2055, and to upgrade its atomic weapons establishment along the way. China, the only NPT nuclear weapon state to maintain a no-first-use policy, nevertheless plans to replace its sea-launched ballistic missiles and intercontinental ballistic missiles (ICBMs). China is reportedly pursuing similar deals.

Another blow to the NPT regime is the proposed U.S.-India deal to provide India, a non-NPT party, with nuclear technology and materials that might enable it to further develop its weapons programs, in violation of commitments made under the treaty to provide such technology and materials only to members of the NPT. Other non-NPT nuclear weapons states, Israel and Pakistan, are reportedly pursuing similar deals.

Indeed, the nuclear weapon states are making timetables for new nuclear weapons, when good faith requires that they should be making timetables for the elimination of their nuclear arsenals, in compliance with Article VI.

As Judge Weeramantry explained, one of the ingredients of good faith is disclosure of material facts. This ingredient seemed sorely lacking when the United States, in this committee, claimed that “U.S. nuclear forces are not and have never been on 'hair-trigger alert.'” How can this assertion be reconciled with a statement issued by the U.S. Air Force Flight Test Squadron Commander on June 14, 2006, in connection with the successful test launch of an ICBM from Vandenberg Air Force Base in California? According to the official news release, the primary purpose of the launch was to assess and demonstrate the operational effectiveness of the Minuteman III weapon system. The missile’s three unarmed re-entry vehicles traveled approximately 4,800 miles in about 30 minutes, hitting pre-determined targets at the Kwajelein Missile Range in the Marshall Islands. The news release read:

“While ICBM launches from Vandenberg almost seem routine, each one requires a tremendous amount of effort and absolute attention to detail in order to accurately assess the current performance and capability of the nation’s fielded ICBM force that is always on alert in Montana, North Dakota, Wyoming, Colorado and Nebraska... This specific test will provide key accuracy and reliability data for on-going and future modifications to the weapon system, which are key to improving the already impressive effectiveness of the Minuteman III force.”

However, one cannot just point the finger at the Nuclear Weapon States. The ICJ affirmed a universal obligation to pursue negotiations for nuclear disarmament, i.e. an obligation which applies to everyone. Then-ICJ President Mohammed Bedjaoui noted that “the goal [of nuclear disarmament] is no longer utopian and that it is the duty of all to seek to attain it more actively than ever.”

The non-nuclear weapon states thus have an obligation to do everything in their power to advance and support nuclear disarmament negotiations and to desist from activities or policies which hinder this.

We believe that the primary obstacles to nuclear disarmament are political and not technical. What is lacking is good faith on the part of governments. But we are here in good faith to encourage and help you. Recent developments indicate that popular opposition to nuclear weapons is finding a voice at last. In Scotland, for example, in the wake of a sustained grassroots campaign at the Faslane Trident submarine base, the nuclear chain is now being broken. In May, Scotland elected a government committed to getting rid of Trident (not just preventing its replacement), and in June the new parliament voted 71 to 16 against Trident. On Friday last week (Oct. 19), the First Minister sent a letter to NPT States Parties informing them of Scotland’s position.

The rapidly growing Mayors for Peace organization, led by the Mayors of Hiroshima and Nagasaki, with nearly 1,800 members in 122 countries and regions, has issued a good faith challenge to governments, calling on them to work together to achieve a nuclear weapon-free world and to immediately de-target cities. In the Czech Republic, the newly created League of Mayors is helping to mobilize public opinion against the bilateral agreement between that country and the United States to install so-called...
missile defense radars in Brdy. In Italy, a massive petition effort, legally requiring the involvement of city officials to verify each signature, is underway to end the stationing of nuclear weapons on Italian territory. The mayors of the cities nearest the nuclear bases are in the lead of this effort.

This year civil society has produced an updated Model Nuclear Weapons Convention for your consideration. The Model Nuclear Weapons Convention was first circulated by the United Nations Secretary-General in 1997 and an updated version was submitted to the 2007 Preparatory Committee for the 2010 Review Conference of the NPT. The case for the Model Nuclear Weapons Convention has been published in the book, Securing Our Survival, launched by three non-governmental organizations in the context of the new International Campaign to Abolish Nuclear Weapons:

"...the inextricable link between the ‘peaceful’ and warlike uses of nuclear technologies and the threat to future generations inherent in creation and use of long-lived radioactive materials must be recognized. We must move toward reliance on clean, safe, renewable forms of energy production that do not provide the materials for weapons of mass destruction and do not poison the environment for thousands of centuries. The true ‘inalienable’ right is not to nuclear energy, but to life, liberty and security of person in a world free of nuclear weapons.”

As NGOs acting in good faith, we are also compelled to convey our view that nuclear weapons do not exist in isolation, and that nuclear disarmament must be considered in connection with nuclear energy and militarism. As many of us agreed in the 1995 founding document of the Abolition 2000 Global Network to Eliminate Nuclear Weapons:

"...the inextricable link between the ‘peaceful’ and warlike uses of nuclear technologies and the threat to future generations inherent in creation and use of long-lived radioactive materials must be recognized. We must move toward reliance on clean, safe, renewable forms of energy production that do not provide the materials for weapons of mass destruction and do not poison the environment for thousands of centuries. The true ‘inalienable’ right is not to nuclear energy, but to life, liberty and security of person in a world free of nuclear weapons.”

As questions regarding Iran’s intentions for its nuclear program spark rising international tensions, against the backdrop of the tragic oil-driven war raging in Iraq, we urge you to consider establishing an International Sustainable Energy Agency to promote the development of clean, renewable sources of energy that do not produce by-products that can be used to create nuclear weapons. Even if not turned into weapons, these materials endanger the health and well-being of all who come into contact with them, especially indigenous peoples who have been disproportionately impacted by the international nuclear weapons and power industry. The agency could be funded by the $250 billion currently going into subsidies for fossil and nuclear fuels. We have drafted a proposed model statute.

The Comprehensive Test Ban Treaty overrides Article V of the NPT, which guaranteed a right to the benefits of peaceful nuclear explosions. Isn’t it time to set aside Article IV, which can only lead to the further spread of nuclear materials around the planet, and replace it with the promise of clean, safe energy for all?

Three non-governmental organizations, the Lawyers’ Committee on Nuclear Policy, Western States Legal Foundation, and the Reaching Critical Will project of Women’s International League for Peace and Freedom, have produced a new book, Nuclear Disorder or Cooperative Security, responding to and expanding upon the Weapons of Mass Destruction Commission report. The book documents the nuclear weapon states’ lack of good faith, and provides a comprehensive set of recommendations for what could and should be done.

The overarching conclusion of Nuclear Disorder or Cooperative Security is that “The concept of security should be reframed at every level of society and government, with a premium on universal human and ecological security, a return to multi-lateralism, and a commitment to cooperative, nonviolent means of conflict resolution.”

The authors of Securing Our Survival explain how security dynamics are changing, thus enabling a new security doctrine to arise. The point was also well put by New Zealand Prime Minister Helen Clark. On the eve of the new century, she observed:

"In the 21st Century, as the ever-expanding exchange of peoples, cultures and trade across nations helps to ease nationalistic prejudices, and as the shibboleths of the Cold War subside, it is time to abolish nuclear weapons and make the world a safer place for all peoples.”

With regard to nuclear weapons, Nuclear Disorder or Cooperative Security recommends:

"Nuclear disarmament should serve as the leading edge of a global trend towards demilitarization and redirection of military expenditures to meet human and environmental needs.”

[... ] In 1625, the Dutch international lawyer Hugo Grotius wrote: “good faith should be preserved … in order that the hope of peace may not be done away with … Rightly [Cicero] says that ‘it is an impious act to destroy the good faith which holds life together.’ To use Seneca’s phrase, it is ‘the most exalted good of the human heart.’”

Now more than ever, the world is desperately in need of good faith.

References

1 International Court of Justice, Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 8 July 1996; the ICJ Advisory Opinion as well as ICJ judges’ separate or dissenting opinions are available as PDF files at http://64.22.89.210/~ialana/?q=worldcourtproject#icj.

2 Cities are not Targets! Report of a seminar organized by Mayors for Peace in the Peace Palace and City Hall in The

3 Tasked by Sweden, the Weapons of Mass Destruction Commission, led by Hans Blix, was asked to “present realistic proposals aimed at the greatest possible reduction of the dangers of weapons of mass destruction.” The commission presented its final report, Weapons of Terror. Freeing the World of Nuclear, Biological and Chemical Arms on June 1, 2006; the final report as well as all studies published on the demand of the commission are available at www.wmdcommission.org. Recommendation 30, p. 109.


7 Statement by Christina Rocca, Permanent Representative of the United States to the Conference on Disarmament in General Debate of the First Committee, October 9, 2007; www.reachingcriticalwill.org/political/1com/1com07/statements/9octusa.pdf.


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12 www.icanw.org. International Association of Lawyers Against Nuclear Arms (IALANA), International Network of Engineers and Scientists Against Proliferation (INESAP), and International Physician for the Prevention of Nuclear War (IPPNW), Securing our Survival (SOS). The Case for a Nuclear Weapons Convention, 206 pages, April 2007. The book is available online at www.inesap.org/books/securing_our_survival.htm; printed copies can be ordered at INESAP (Germany) and ICAN (Australia).


16 Ibid., p. 196.


18 Ibid., p. 196.

19 Hugo Grotius, De Jure Belli ac Pacis [The Law of War and Peace], 1625, Chapter XXV.

On behalf of the NGO community, this statement was delivered to the First Committee of the UN General Assembly at the United Nations in New York on October 26, 2007. It was prepared with input from NGOs including Lawyers’ Committee on Nuclear Policy; Nuclear Age Peace Foundation, NY; and Reaching Critical Will of the Women’s International League for Peace and Freedom.

JACKIE CABASSO is Executive Director of the Western States Legal Foundation in Oakland, USA; wslf@earthlink.net.
Mr. Chairman,

on behalf of civil society everywhere, I’d like to thank you, the Secretariat and the delegations to the First Committee for dedicating some time of your debate to hear the perspectives from those you serve, the peoples of this planet for whom the United Nations was created to save from the scourge of war. In disarmament matters in particular, civil society has had to struggle many years for such a platform, and we are honored to be those civil society representatives here today.

I will not waste our precious minutes listing the copious – and growing – number of ways that humanity relies on outer space. Every person in this room understands that space technology guides our daily lives. The Chairman of the Committee on Peaceful Uses of Outer Space (COPUOS), Mr. Gerard Brachet, delivered a very thorough presentation in this hall just the other day, where he effectively outlined some of these critical civilian space applications, including weather tracking, global communication, and disaster management such as that which was required in the post-Katrina catastrophe. I am sorry to add that, during these dangerous times of climate change, this latter use may be all the more necessary.

Further, all of us here are fully aware of the very serious risks posed by our increasing reliance on space. Currently, there are approximately 11,000 objects of space debris larger than 10 cm orbiting the Earth, according to NASA. A single piece of – either from a discarded peaceful rocket or from an irresponsible weapon test – could knock out a satellite and cause serious disruptions, at the very least. If we do not act to prevent the weaponization of space, the testing of such space-bound weapons will increase this “space junk” exponentially. Moreover, the weaponization of space – however soon that may come – presents much graver consequences for life on Earth, beyond just these issues of garbage.

Thus, there are two pressing issues regarding our common space security which need prompt attention: 1. preventing space debris from adversely affecting the present and future uses of space and 2. preventing an arms race in space. What we must do now is seriously debate and agree upon the best way by which we, as the international community, can strengthen our cooperation in space, the beloved “final frontier” that has grasped our imagination and wonder for generations.

Some advocate, as a quick fix, a “rules of the road” approach. Several experts such as Michael Krepon of the Henry Stimson Center have proposed a Code of Conduct be promptly instituted that could include provisions to:

- minimize satellite-killing debris in space,
- avoid and reduce the risk of collisions in space,
- avoid or announce in advance dangerous maneuvers in space,
- create special caution areas around satellites, and
- cooperate on space traffic management.

In this same vein, the Scientific and Technical Subcommittee of COPUOS adopted space debris mitigation guidelines earlier this year, which have been submitted to the UN General Assembly’s Fourth Committee this week. These guidelines, much like the rules of the road outlined by the Stimson Center, are meant to be voluntary rather than legally-binding, to be adopted through national mechanisms “to the greatest extent feasible.”

Through such non-legally binding, voluntary measures, we can circumvent some of the issues that have mired space security discussions in the past, such as definitional issues (i.e., how to define a space weapon when a dislodged bolt from an old satellite can destroy a space object just as effectively as a space mine) or lengthy negotiations followed by difficult and elusive ratification processes.

However, by avoiding the difficult discussions on definitions, or failing to explore effective verification mechanisms for ensured compliance, we also avoid addressing the threat of an arms race in space.

The deployment of weapons in space or territorially-based anti-satellite weapons will adversely and immediately affect the cooperative security foundation of the nuclear Non-Proliferation Treaty and possibly the very foundation of the UN system itself. Unilateral weaponization of space will degrade the very cooperation needed to address nuclear non-proliferation and disarmament, to protect the climate and to solve problems of terrorism and
poverty. Failure to cooperate in the heavens will destroy our ability to cooperate on Earth.

Moreover, as if war on Earth wasn’t catastrophic enough, imagine if one country blinds a nuclear-armed country during conflict, by knocking out their satellites and “blinding” the commanders to what is happening in the combat zone. That, according to retired US Ambassador Robert Grey, is “when the finger on the nuclear button gets itchy.” With such unimaginable consequences, we must make the most serious efforts possible to prevent space from becoming another theater of war.

How then, to proceed? The WMD Commission had recommended a Review Conference of the Outer Space Treaty (OST). Russia and some partners are pushing for a brand new treaty, the often mentioned though yet-to-be-publicly-released PPWT, the Prevention of Placement of Weapons in Outer Space Treaty. Well, we missed the 40th anniversary of the OST, the occasion on which Dr. Blix and his fellow commissioners had hoped would be utilized for a Review Conference, and a wholly separate treaty will certainly be rejected at this time; many states will be dubious of a treaty that lacks verification – as the treaty will certainly be rejected at this time; many states might make the most serious efforts possible to prevent us from becoming another theater of war.

Therefore, we believe that the most useful step that we can take now – not in 2008, not in another 10 years and another OST anniversary, but now – can be found in the report of the Secretary-General’s Advisory Board on Disarmament Matters, which had suggested that Secretary-General Ban convene, at the earliest possible time, a high-level expert panel. Its mandate will include analyzing the present uses, threats, risks and opportunities presented by humanity’s proliferating space capabilities, both military and civilian, taking into account space-related developments, achievements, and challenges that have arisen since the Outer Space Treaty’s inception, and making recommendations regarding the most effective way forward. Drawing from expert scientific, political, military and legal analyses, the panel would contribute immensely toward facilitating a global consensus on the sticky issues such as definitions and verifiability, laying the necessary foundation for real movement when the political climate is ripe, thereby possibly expediting the lengthy negotiation process of a new treaty.

At present, no forum exists for the international community to comprehensively examine outer space security. COPUOS’ mandate is limited to peaceful uses. The Geneva Conference on Disarmament is stuck in its own self-perpetuating quagmire of inaction. And is any multilateral forum, whether in Vienna, Geneva, or New York, soliciting the perspectives or communicating effectively and continually with the increasing number of commercial actors in space? With such limited communication and an absolute dearth of a convergence of relevant perspectives and analyses, we are unable to address the very serious threats we face; the security of our heavens and those of us that live beneath them, remain at risk. We urge your support of this suggestion of the Secretary-General’s Advisory Board and your voicing such support in either inclusion in a resolution or letters in support to the Secretariat.

Mr. Chairman, we have before us an unprecedented opportunity. Having survived the cold war nuclear arms race, and with a burgeoning framework of cooperative security like none the world has ever seen, we are capable of undertaking conflict prevention measures in the highest of places. With a cooperative framework firmly in place and, bolstered by our exponentially advancing technological abilities, together, we will be able to explore and utilize the firmaments, in previously unimaginable ways, truly benefiting all humankind.

Thank you, Mr. Chairman.

References
2 In May of 1998, a Galaxy IV satellite failed. Eighty percent of US pagers went blank, 37 million people were immediately affected, some radio and television stations went off the air, and some gas stations and retail stores could not validate credit card transactions. Imagine the consequences of a robust anti-satellite test program or a dedicated organized attack on space assets. Imagine if we do nothing to prevent further space debris.
3 COPUOS adopted seven guidelines:
1. limit debris released during normal operations,
2. minimize the potential for break-ups during operational phases,
3. limit the probability of accidental collision in orbit,
4. avoid intentional destruction and other harmful activities,
5. minimize potential for post-mission break-ups resulting from stored energy,
6. limit the long-term presence of spacecraft and launch vehicle orbital stages in the low-Earth orbit (LEO) region after the end of their mission, and
7. limit the long-term interference of spacecraft and launch vehicle orbital stages with the geosynchronous Earth orbit (GEO) region after the end of their mission.
4 This recommendation is similar to the provision included in recommendation #45 of the WMD Commission.
report, which calls for states to “set up a group of experts to
develop options for monitoring and verifying various com-
ponents of a space security regime and a code of conduct,
designed inter alia to prohibit the testing or deployment
of space weapons.” See Weapons of Terror, op.cit., p. 148.

Should the Conference on Disarmament (CD) agree on a
program of work, such a high-level panel would still be useful,
in that it would be more comprehensive and be able to solicit
a much wider range of views than the CD currently allows for,
including those from civil society and the private sector. Fur-
ther, depending on the modalities of the panel, it is possible that
the panelists would be ostensibly free from national interest
constraints and rather act independently, in the manner of the
Weapons of Mass Destruction Commission.

On behalf of the NGO community, this statement was
delivered to the First Committee of the UN General
Assembly at the United Nations in New York on Octo-
ber 26, 2007. It was the first ever statement by civil society to the UNGA First Committee focusing on outer space security.

RhIANNA TySO is a Senior Officer with the Global Security
Institute and a Consultant with the Secure World Foundation. GSI, New York Office, 675 Third Avenue, Suite 315,
New York, NY 10017, USA; rtyson@gsinstitute.org.

I had heard much about Janet Bloomfield, long before I met
her. She took my place in the office at West Midlands CND
after I left the UK in 1985 and went on to become the Chair of
National CND (Campaign for Nuclear Disarmament). But I
didn’t meet her until 1994 at a Non-Proliferation Treaty con-
ference at the UN in Geneva. There, Janet, Pamela
Meidell and I swore – like the three witches of Mac-
beth – that we were soul sisters. Now our sister Janet
has left us. She died on April 2nd, suddenly.

I could list all the wonderful things she did, but
there isn’t enough space for that and it wouldn’t really
tell you who she was. These are the bare facts: She was
active in the movement since 1981, Chair of CND
from 1993 to 1996, co-founder of the Abolition 2000
network, co-organiser of the Atomic Mirror pilgrim-
age in 1996, worked with Oxford Research Group for
over ten years. And she was Richard’s wife, Lucie’s
and Robin’s mother.

But Janet’s real achieve-
ment was simply being herself.
She was an expert at integra-
tion, she inspired people to
work together. She loved. She
brought sunshine into every
room she entered with that
enormous smile she wore, even
in the darkest rooms of the UN
basement where we worked.

She was able to pull us back to more reasonable
ground when we were going off on crazy tangents.
She listened and empathised like only a mother can.
She was a Quaker – and so she was a Friend. Janet’s
love lives on in all those that she loved and who loved
her, and they were very many.


Making Peace and Security NGOs More Effective, by
Janet Bloomfield, posthumously published by Oxford
Research Group; www.oxfordresearchgroup.org.uk/
winningforpeace.pdf.

Janet Bloomfield

1953–2007

Mother – Soul Sister – Friend

Xanthe Hall
The taboo against the use of biological weapons goes back a long way in history. This stigma is reflected in the international efforts to prevent any individual from becoming a victim of biological weapons. The effort to define the rules of war and the use of particular weapons systems puts the Biological and Toxin Weapons Convention (BTWC) at the centre of humanitarian law.

The first international agreement on chemical and biological weapons was the Brussels Convention in 1874 on the law and customs of war which “forbids the employment of poison or poisoned weapons” under Article 13a. In 1899, states pledged as part of Declaration II not to employ asphyxiating or deleterious gases under The Hague Convention. In 1928, the Geneva Protocol came into force prohibiting the use of “asphyxiating, poisonous or other gases and of bacteriological methods of warfare.” Finally, in the late 1960s, negotiations on a bioweapons treaty began. The treaty opened for signature in 1972 and came into force in 1975.

There is, however, a new dimension to this issue. Rapidly spreading biotechnology such as gene engineering and cutting-edge techniques such as RNA interference have the extraordinary potential to help those suffering from disease. However, at the same time they can make the dissemination of a biological weapon more lethal, more targeted and more concealed. We are faced, therefore, with a dilemma of possibly burdensome security measures against stifling global health and industrial benefits.

This article will describe the current status of the BTWC and highlight some of the challenges it is now facing in an evolving international arms control climate.

The Biological and Toxin Weapons Convention

Article I of the BTWC reads:

“Each State Party to this Convention undertakes never in any circumstance to develop, produce, stockpile or otherwise acquire or retain:

(1) Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes.”

This prohibition provides the basis of the norm set against biological weapons and is referred to as the General Purpose Criterion for its emphasis on the intention of the actor.

The General Purpose Criterion provides an obvious thin line between prohibited activities and those allowed under the Convention and makes reference to the particular dual-use nature of the biological sciences. It is intended to prevent the proliferation of biological weapons while defending the sovereign rights of States Party to develop defences against any form of biological attack.

There are three instruments within the framework of the Convention designed to enforce the ban on biological weapons. The first are the Confidence Building Measures which are a politically-binding information exchange regime on treaty relevant activities and events aimed at building transparency. They cover the following topics:

- maximum containment facilities,
- biodefense programmes and facilities,
- outbreaks of concern,
- publications and contacts between scientists,
- national implementation,
- past offensive and defensive biological weapons programmes, and
- vaccine production facilities.

This mechanism, however, has been plagued with weak participation and an inconsistent quality of submissions. They have not yet been able to build confidence in compliance for which they were designed.

The second mechanism is that of a consultative meeting which can be called by any state in order to “clarify any problem in the application or provisions of the Convention.” This mechanism has been invoked once when the United States was accused by Cuba of disseminating a plant control agent on Cuban territory in 1997.

The third is a mechanism for challenge inspections under Article VI of the BTWC. Any state can lodge a complaint to the Security Council of the United Nations on compliance to the provisions of the Convention of another state. The Security Council votes on conducting
Verification under the BTWC

Verification is one of the central elements of any arms control agreement. In efforts to prevent the proliferation of nuclear and chemical weapons, States Parties successfully negotiated verification mechanisms bringing strength through compliance monitoring to each convention. The BTWC, on the other hand, does not have a legally binding verification mechanism for assessing state compliance. The three instruments mentioned above are by no means substitutes for such a system. Verification under the BTWC has been discussed before but poses a particular problem due to the widespreadedness of biosciences. In other words, for verification to be comprehensive, all relevant public, private, government, or academic facilities must be covered by the system. Verification must provide reliable enough data to ensure high confidence in treaty compliance.

Discussion on a verification mechanism began at the Third Review Conference in 1991. The Ad Hoc Group of Governmental Experts, which came to be known as VEREX, was directed to study possible verification measures. VEREX laid the groundwork for the Ad Hoc Group, which became the negotiating body assigned to produce a legally binding instrument. To this end, the Ad Hoc Group met 24 times between 1995 and 2001 and was able to produce a text basing a Verification Protocol on three major principles:

- a legally binding declaration system,
- routine and challenge inspections,
- a central organisation, Organisation for the Prohibition of Biological Weapons.

This was a long process and there was still some dissatisfaction by the time the Ad Hoc Group chairman introduced a compromised text. At the last session of the Ad Hoc Group, the United States withdrew its support for the Verification Protocol, citing blatant risks to the economic viability of its pharmaceutical and biotech industries. Later, at the 5th Review Conference, the Verification Protocol was suspended indefinitely with the US's insistence that the AHG no longer meet. The US suggested that States Parties seek other mechanisms for strengthening the treaty other than multilateral verification.

Challenges to Biological Arms Control

The lack of a multilateral verification system and the threat that non-state actors acquire biological weapons are two of the major challenges to the Convention. These represent, on the one hand, state compliance, and on the other, the individual's compliance. Thus enforcement of the treaty must be achieved through a variety of means. While it is clear that an international verification system will build accountability for state compliance, a multilateral instrument will not help to uncover potential terrorist plots using biological weapons. Efforts to prevent the development of bioweapons by terrorist individuals must rely on efficient implementation of the provisions of the Convention into national legislation and regulation. This is the reason national implementation occupies a central position in the international efforts to strengthen the BTWC and other regimes including Security Council Resolution 1540. Ultimately, terrorist use of biological weapons is rare, and there is no indication of an increase effort on the part of terrorist organisations to acquire biological weapons. The BTWC must nevertheless be enforceable domestically.

There are, however, other challenges facing the Convention.

Universality of the BTWC

A fundamental issue that plagues the Convention is its relatively low membership. As of April 2008, 33 years after the coming into force, there are 161 Member States from 192 UN recognised countries. Furthermore, when the age of the Convention is factored, the BTWC compares badly to other arms control treaties:

- Chemical Weapons Convention: 182 member states in 10 years,
- Nuclear Non-Proliferation Treaty: 190 member states in 37 years,
- Mine Ban Treaty: 155 member states in 10 years.

Weak participation brings little legitimacy and importance to its obligations. Not to mention that non-member states, such as Israel, Egypt, and Syria, are not bound by the international law prohibiting biological weapon development.

Biological and Biochemical Non-Lethal Weapons

As advances in the biological sciences are made, an increased interest in the development of biological and biochemical “non-lethal” weapons has been seen. Non-lethal weapons supposedly promise a more humane conflict with fewer casualties. Non-lethal biochemical weapons have been used before. Fentanyl was allegedly used by Russian police in the 2002 siege of a Moscow theatre being held by Chechen militants. The theatre was flooded with the incapacitant resulting in the deaths of at least 168 people.

However, non-lethal weapons are an increasingly problematic issue in the arms control arena. Firstly, they
threaten to erode the pillars of the Chemical Weapons Convention and the BTWC if States Parties have increasing know-how on the development and use of non-lethal biochemical weapons. Secondly, there are operational issues. In conflict, these substances might be used as a force amplifier when used in combination with conventional lethal weapons, i.e. first the incapacitating agent is used indiscriminately followed by lethal force on incapacitated enemies. Furthermore, there is a concern that non-lethal weapons proliferate to non-state terrorist organisations. Their use in warfare or in domestic situations will likely only speed their proliferation to actors who will be more likely to use them and less concerned by their non-lethal nature. Thirdly, there are technical concerns. The lethality of non lethal biochemical weapons, like any drug, is always dependent on dosage and duration of exposure. Finally, there is the issue of retaliation. In conflict retaliation is rarely proportional. There is a concern, therefore, that the use of non-lethal weapons in conflict will lead to increasingly lethal responses.

The position of non-lethal biochemical weapons within the international arms control regime is unclear. The Chemical Weapons Convention allows the use of chemical agents in law enforcement and riot control scenarios. In the BTWC no reference is made to the lethality of an agent. However, the General Purpose Criterion might also allow the use of non-lethal agents in domestic riot control if riot control is interpreted as “prophylactic, protective and other peaceful purposes.” Furthermore, biochemical non-lethal weapons, as substances acting on the biochemical processes of the organism, may not necessarily fall under the “microbial or other biological agents, toxins whatever their origin or method of production” as prescribed in Article I.

National Implementation
Effective national implementation is important for preventing terrorist actors from acquiring biological weapons. It allows individuals to be prosecuted and penalized under domestic law as well as providing local law enforcement to take preventative and investigatory actions against infringements. Without effective national implementation, although the state would be bound by the BTWC’s obligations by international law, there would be no mechanism to enforce the treaty domestically. Many States Parties to the BTWC have not yet implemented adequate national legislation.

National implementation is required under Article IV of the Convention, as well as under Security Council Resolution 1540 of 2004. The relevant sections read as follows:

BTWC Article IV: “Each State Party to this Convention shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition, or retention of the agents, toxins, weapons, equipment and means of delivery specified in article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere.”

Security Council Resolution 1540: “…all States, in accordance with their national procedures, shall adopt and enforce appropriate effective laws which prohibit any non-State actor to manufacture, acquire, possess, develop, transport, transfer or use nuclear, chemical or biological weapons…”

National implementation therefore implies passing legislation and regulations in the following areas:

- penal law which should include assisting forbidden activities and specifying penalties,
- procedural criminal law allowing the enforcement of treaty provisions and prosecution,
- regulations in biosafety and biosecurity, and
- regulation in the transfer of biological material or equipment, including domestic and international exports and imports.

Addressing the BTWC’s Deficits

There are two levels on which the challenges highlighted above can be addressed. First, the Convention and its States Parties can provide a platform through which new instruments and regimes can be designed to fill the BTWC’s deficits. And second, outside the framework of the Convention there are a number of international and non-governmental organisations that are focused on strengthening the norm.

With verification off the negotiating table, and without any prospect for it being put back on, States have had to adopt other measures under the Convention. One such measure are the intersessional process meetings. These meetings bring States Parties to Geneva on a regular basis to discuss issues related to the Convention. Between the 6th and the 7th Review Conferences these topics will be:

- ways and means to enhance national implementation,
- regional and sub-regional cooperation and implementation of the Convention,
- national, regional, and international measures on biosafety and biosecurity,
- oversight, education, and awareness-raising and/or development of codes of conduct,
- enhancing international cooperation, assistance, and exchange in biological sciences and technology for peaceful purposes, and
provisions of assistance and coordination with relevant organisations.

While the purpose of these meetings is to have constructive dialogues, it is also intended to allow more frequent contact between States Parties. It is hoped that this will help build common ground, if only through more personal and frank discussions.

Also within the framework of the Convention is the work of the Implementation Support Unit which was created at the Sixth Review Conference in December 2006. This body functions as the gravitational centre of the Convention. It coordinates the meetings and collects, assembles, and distributes the information submitted by the States Parties in fulfilment of the Confidence Building Measures. The Implementation Support Unit provides help with national implementation and creates a constant link between all States Parties and between States Parties, non-governmental organisations, and the general public.

Bridging the goals of the European Union and the BTWC is the European Union’s Joint Action in Support of the Biological and Toxin Weapons Convention of 2006. Originating in the European Union’s own foreign policy interest, it seeks to strengthen the Convention by means of achieving universality for the BTWC and improving national implementation. The universality programme consisted of five workshops carried out in areas of low BTWC membership in order to raise awareness of and support for the Convention. The goal was to promote greater membership. The programme for national implementation consisted of technical expert visits organised in countries who requested assistance with drafting or ameliorating national legislation. The Joint Action is scheduled to come to an end in the near future and initial indications suggest positive results although more analysis has to explore the success. A second Joint Action in the area of biosafety and biosecurity is being planned for 2008. This programme will focus on education and awareness-raising and on technical assistance in laboratories. In parallel, the EU has planned to explore the idea of a fact-finding mission on the physical protection of biolaboratories.

Outside the BTWC, there is a mechanism which allows the Office of the UN Secretary General to investigate alleged uses of chemical or biological weapons. These investigations allow an independent ad hoc inspection with which States Parties must comply. However serious, “alleged use” is a very restrictive definition for invoking this mechanism. Many would have the instruments widened to include any alleged breaches of the BTWC.

While non-governmental organisations have limited access to the multilateral decision making process, the small community of biological weapons experts is often sought for its opinions. In this light, non-governmental organisations have had mixed successes in lobbying states. There are, nevertheless, a number of projects that aim to strengthen the ability to prevent the use and proliferation of biological weapons, for example:

- BioWeapons Prevention Project: BioWeapons Monitor
- Research Group for Biological Weapons and Arms Control, University of Hamburg: National Implementation of Treaties and Norms Prohibiting Weapons of Mass Destruction (WMD)
- Sunshine Project: Transparency and Public Accountability in Biodefense
- Outreach to scientists, education, and awareness-raising being carried out by a number of institutions, including Bradford University, Harvard Sussex Program, BioWeapons Prevention Project.

Conclusion

The Biological Weapons Conventions, despite its numerous deficiencies, is the strongest legal norm against the proliferation and development of biological weapons. Although we face different challenges today than at the time it was created, the BTWC still has a role to play in international security and should not be abandoned. Rather, it should be adapted to current challenges while keeping in mind the broader issues and its original goal, namely the multilateral dimension of biological arms control.

References

1. Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, 1928.
2. Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, 1975. Lacking an Organisation for the Prohibition of Biological Weapons, at the request of the President of the Sixth Review Conference, the Department of Peace Studies of the University of Bradford maintains a website for the BTWC where the full text of the Convention and other treaty-relevant documents mentioned in this article can be found: www.opbw.org.
The risk of children under 5 years of age to contract leukaemia increases the closer they live to a nuclear power plant. This is the result of an investigation of the German Childhood Cancer Registry (GCCR) in Mainz carried out on behalf of the German Federal Office for Radiation Protection (BfS). The investigation concludes that in the study period from 1980 to 2003, within a radius of 5 km around the reactors, 37 children contracted leukaemia. On the statistical average, 17 cases would have to be expected. About 20 cases can thus be attributed to the fact that they live within this radius.

The investigation, which was headed by Professor Dr Maria Blettner and accompanied by a panel of 12 experts appointed by BfS, comprised 1,592 children with cancer and 4,735 children without cancer (so-called controls were similar with respect to age and gender) under five years. 41 districts in the vicinity of the 16 nuclear power plant sites in Germany were investigated. The risk to contract a tumour or leukaemia significantly increased with the vicinity of the residence to a reactor site. This finding can mainly be attributed to leukaemias in children under the age of five.

The study is the third in a series of corresponding investigations of the German Childhood Cancer Registry. However, it essentially stands out from the two preceding studies regarding its strength of conclusion. The significant advance of this investigation is that not only disease rates in defined areas were compared. For the first time, exact data on the distance of a residence to a reactor could be taken into account in a case-control study, in fact for both children with cancer (cases) and children without cancer (controls).

The study result is in line with similar investigations carried out world-wide. In a so-called meta-analysis in which previous ecological studies relating to the occurrence of childhood cancer in the vicinity of nuclear power plants were summarised and evaluated and which was published this year, such a correlation has been determined, too. However, it is surprising that the leukaemia risk among children increases demonstrably with decreasing distance of their residence to the reactor site.

The detailed final report of the study and background information (some only in German) is available at www.bfs.de/de/kerntechnik/kinderkrebs.
The Physicists’ Efforts to Control Nuclear Weapons

FRANK VON HIPPEL

In 2006, the German Research Association Science, Disarmament and International Security (FONAS) had its tenth anniversary. FONAS is an organization of natural/mathematical scientists doing professional research in these fields in Germany. To celebrate the anniversary, a symposium was held on November 30, 2006, in Berlin. Frank von Hippel presented a “walk through history and an inquiry into the determinants of effectiveness in advising the government and the public” and assessed the status of the relevant research community in Germany. His paper is slightly abridged below; the full text is available at www.fonas.org/10jahrefonas/index.html.

I will give what will be, in effect, four talks – but the last three will be short. The first one will give some perspective on when we have been effective and on the situation with which we are confronted with today. Second, I will say a little bit about some personal experiences. Third, I will advertise a new effort, the International Panel on Fissile Materials, of which Martin Kalinowski and Annette Schaper are the German members.1 Finally, I will give my own little contribution to the perspectives that are being offered in celebrating the tenth anniversary of FONAS.

World War II and its Aftermath

The physicists’ activism started with the nuclear bomb. In our original sin, for three years a few physicists tried to get the bomb project going and then it was four years in the making in the U.S. During the war, some people started thinking about the implications. Niels Bohr took a leading role, concerned about an arms race. James Franck and Leo Szilard similarly warned about the danger of an arms race if the bomb was used in a surprise attack on Japan. But the leadership of the Manhattan Project advised that the only way of using it effectively was to use it without warning.

Of course, this was all within a very secret world during World War II. But, after Hiroshima and Nagasaki, scientists were freer to speak and they had for a while a very large audience. Robert Oppenheimer played the leading role among the scientists in developing the Acheson-Lilienthal proposal (later modified in the Baruch proposal) to put under international control “dangerous” nuclear facilities that could be used to make highly-enriched uranium or separated plutonium.2 But the proposal failed.

Domestically, in the United States, the younger scientists who did not want to work for the Army any more fought for civilian control of nuclear research and established the Federation of American Scientists and the Bulletin of the Atomic Scientists. They won civilian control but they also made lots of enemies in the fight. Soon they were on the defensive over atomic-spy concerns. The internationalism of this community of young activists-physicists brought them into suspicion. I will mention some interesting books as I go along. One chapter in Jessica Wang’s American Science in an Age of Anxiety3 was based on 23 volumes of declassified documents from the Federal Bureau of Investigation’s dossier on the Federation of American Scientists for the period 1945 to the 1970s. (Thirty percent of the files remained classified.)

The H-Bomb Decision

The next major issue was the decision to develop the H-bomb. It occurred at the height of the Cold War: the Berlin blockade, the panic that was caused by the first Soviet nuclear test, and the discovery of Klaus Fuchs as a nuclear spy for the Soviet Union. The U.S. Atomic Energy Commission’s General Advisory Committee, on which many of the leading scientists from the Manhattan Project served, was asked to provide advice. As far as the government was concerned, they gave the wrong advice – they advised against developing this bomb.

In particular, there is this remarkable sentence in their report: “The use of an H-bomb carries much further than the atomic bomb itself the policy of exterminating civilian populations.” I have never seen such a strong language in an advisory report. The government’s reaction was very negative; in fact, it ended the career as a government advisor of Robert Oppenheimer, who was the Chairman of this Committee. The decision to remove his security clearance referred to his not being enthusiastic enough about the H-bomb project.4 Then Joseph Stalin died, Nikita Khrushchev denounced Stalin’s reign of terror, and the Iron Curtain started becoming more porous. The Russell-Einstein appeal called for an East-West dialogue, and the Pugwash movement started such a dia-
logue inside the scientific community that continued on and off thereafter.5

Nuclear Fallout

The next upsurge of activism on nuclear-weapons issues in the scientific community was in response to public concern about the effects of global radioactive fallout from nuclear testing.

Figure 1 shows the “local” fallout from the thermonuclear BRAVO test on March 1, 1945, the first test of a real thermonuclear weapon, i.e. with lithium-deuteride as the principle fusion fuel. The wind changed and the lethal area for the fallout (more than 300 rads) covered some populated atolls. Fortunately, in the case of Rongelap atoll, nobody was killed because people lived at the southern end. There was also a Japanese fishing vessel, The Lucky Dragon, in this area, and one of the fishermen died. This is how the incident became public and started the test ban movement. The scientific community was activated and ten thousand scientists signed a petition organized by Linus Pauling. Andrei Sakharov also was activated. In the West, nobody knew who Sakharov was at that time, but he published an article on non-threshold biological effects that has been republished in translation in Science & Global Security.7

Like Pauling, Sakharov was worried about the genetic effects of the global fallout. Both suggested that the risk of genetic damage is linear with dose. The radiation insult to the population was quite small from this global atmospheric fallout – it was equivalent to about one year’s worth of natural background – but the natural background is not benign. Based on the linear hypothesis, one hundred thousand to a million cancer deaths may result from the fallout. As Pauling very eloquently said, “no human being should be sacrificed with the project of perfecting nuclear weapons that could kill hundreds of millions of human beings and devastate this beautiful world in which we live.”5 Thanks to the anti-testing movement – and also the Cuban missile crisis, which sobered up the US and Soviet leadership of the time – we got the 1963 Partial Test Ban Treaty. Unfortunately, it was an environmental treaty more than an arms-race-ending treaty. It took much longer to actually get a real Comprehensive Test Ban Treaty, which of course is still not officially in force.

Defense Against Ballistic Missiles

In 1957, the US government was alarmed by the launch of the first Soviet satellite, Sputnik, and the scientists were invited back into the White House to advise the government. A major debate erupted around missile defense. The President’s Science Advisory Committee (PSAC) advised that it was infeasible, but the Soviets deployed a missile defense system around Moscow. President Johnson tried to get a bilateral agreement to not go ahead with missile defense but was rebuffed by the Soviet leadership. So, in 1967, President Johnson decided to deploy a missile-defense system to defend the entire United States.

Richard Garwin, a member, and Hans Bethe, a former member of the President’s Science Advisory Committee went public, explaining why they thought that a missile defense system would not work. For me, their
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The article in Scientific American is probably the most important public-interest arms control physics article ever written. It educated the physics community on these issues. I was myself activated by the public debate that occurred over missile defense. But again the scientists by themselves could not make a difference. You needed a public movement.

The public movement was caused by the Defense Department’s decision to deploy nuclear-armed missile interceptors in the suburbs of several big US cities. Each siting effort brought forth local opposition with the result that Congress became interested in this issue. And as Congress listened to the scientists, it became increasingly skeptical about missile defense. Ultimately, President Nixon, who had pressured President Johnson into going ahead with deployment, had to sign the Anti-Ballistic Missile Treaty in 1972. But Nixon was not happy about the role of the scientists and he abolished the President’s Science Advisory Committee. So the scientists were outside again.

The Anti-Arms Race Movement in the Early 1980s

There was another wave of activism in the early 1980s. In Europe, it was provoked by the U.S. decision to deploy intermediate-range missiles to counter missiles deployed by the Soviet Union. In the US, it was inspired by the rhetoric of the early Reagan Administration about the possibility of fighting and winning a nuclear war. Again, there was public interest in this issue and President Reagan responded with his answer to the dangers of nuclear weapons, the “Star Wars” program. This activated the scientists again. This is also when I became involved in these backchannel scientists’ discussions.

The initiative that precipitated my involvement came from the Soviet side, from the newly formed Committee of Soviet Scientists for Peace and Against the Nuclear Threat chaired by Evgeny Velikhov. After President Reagan’s “Star Wars” speech in March 1983, this committee began reaching out to try to engage its counterparts in the West. The committee became convinced early on, before Mikhail Gorbachev came into power, that the Soviet response to Star Wars should be “asymmetric,” i.e. countermessures to U.S. defenses rather than getting into the Star Wars business itself.

When Gorbachev came into power in the spring of 1985, we learned that Velikhov was his advisor on such matters. Gorbachev picked up where Khrushchev had left off with his test moratorium of 1958. In August 1985, Gorbachev launched a test moratorium of his own, and invited the US to join in.

One of the responses of the Reagan Administration to Gorbachev’s initiative was to suggest that the Soviets were probably still doing small tests. So, at the centennial for Niels Bohr in Copenhagen in the fall of 1985, when I was sitting in a bus with Velikhov, he suggested to me that the Soviet Union could invite an outside group in to determine if the Soviet Union was carrying out small tests. After this was agreed at a workshop in Moscow in May 1986, Charles Archambeau and Tom Cochran recruited some seismologists from the University of California under the auspices of the Natural Resources Defense Council (NRDC). The group was allowed to install seismometers at three sites around the Soviet test site in Kazakhstan. This had a large impact on the US debate over nuclear testing.

Figure 2 shows Congressman Markey, who is still very active on these issues, holding up the first seismogram from Kazakhstan, which did show a test – a test in Nevada.

This was a real reversal of Soviet reluctance to have in-country inspections to verify a test ban. Here the Soviet Union was unilaterally offering in-country inspections to a non-governmental organization!

In January 1987, Gorbachev allowed Sakharov to come back from Gorky, where Sakharov had been in exile...
since 1979. Velikhov organized an international scientists’ meeting where Sakharov spoke. The impasse in U.S.-Soviet nuclear arms control at the time was that the Reagan administration was willing to cut the arsenal of offensive weapons, but was not willing to give up Star Wars. The Soviets wanted Star Wars to be stopped as a condition of offensive reductions. Sakharov urged Gorbachev to cut this linkage. He said that Star Wars would collapse under its own weight – which it did later on. Gorbachev did cut the link and agreed to the Intermediate-range Nuclear Forces Treaty (INF, 1987) and the first Strategic Arms Reduction Treaty (START, 1991). Under the influence of advisors who were influenced in turn by the analyses of West European advocates of “non-offensive defense,” Gorbachev also withdrew ten thousand tanks from East Germany and then, in parallel with the first George Bush, de-nuclearized the Russian and U.S. armies and surface navies. All these initiatives were major contributors in the ending of the Cold War.

Nuclear Glasnost

As a high watermark of nuclear glasnost, in July 1989, in cooperation with the NRDC, Velikhov organized a tour of Soviet nuclear sites. The NRDC invited three members of the US House of Representatives, journalists from the New York Times and Washington Post and some other people, including me. We were the first outside visitors to the first Soviet plutonium production complex in the Urals. They showed us that they had shut down some of the reactors there (see Figure 3). (This was actually for me, because I was already advocating a Fissile Material Cutoff Treaty.)

We also visited a laser directed beam test site that the U.S. Defense Department had been citing as evidence of a Soviet Star Wars program (see Figure 4).10 We found the facility equipped with some ten-watt ruby lasers and a twenty-kilowatt CO2 laser. The US at the time had a facility with a million-watt laser. When we brought back the pictures of the Soviet lasers, the US laser people exclaimed, “toys!”

Figure 3: Frank Hippel in Soviet reactor (from NRDC)

Figure 4: Laser directed beam test site sketch

Figure 5: Gamma-ray spectrum recorded on the launch tube directly above the warhead
Finally, over the objections of the leading Russian weapons scientists, we were allowed to measure gamma radiation from a Russian cruise missile warhead in its launcher on a Soviet cruiser in the Black Sea off of Yalta. The reason was that the Soviet Union wanted to include sea-launched nuclear-armed cruise missiles in the START treaty but the G.W.H. Bush Administration was arguing that it was impossible to tell the difference between a conventional and a nuclear-armed cruise missile.

Figure 5 shows the gamma spectrum from this Soviet warhead measured with a germanium crystal. We did not think that any design information could be obtained from this spectrum, but we were wrong. One could not infer the design from the spectrum but weapon designers could compare the spectrum with the spectra from known designs.

Activists and Analysts

One of the lessons I have learned from my involvement in the nuclear policy debate is that it takes activists to create a political audience. But when there is an audience, we scientists can contribute credibility to the argument made by the activists that there are alternatives to official policy. I have given my three big examples: the anti-fallout movement, the movement against anti-ballistic missiles (the suburban uprising against the anti-missiles), and the anti-nuclear arms race movement of the early 1980s.

From this perspective, one of the great misfortunes for the cause of the nuclear arms controllers is that there has been no uprising since. We desperately need one. I think that the resistance to nuclear disarmament is much less than it was, but our pressure is even less than the resistance, because the peace movement is largely demobilized, and we are now in a situation where the Cold War nuclear Doomsday machine lingers on.

In fact, when you look at the nuclear weapons debate in the US today, it is all about nuclear terrorism. Nuclear terrorism is something I am concerned about, but nuclear terrorists could not end civilization – only the countries that are armed with nuclear weapons can do that. But we have to be ready when there is a political opportunity. We never know when it will come. Each of the uprisings that have I talked about were surprises: the public reaction to the very low level of global fallout, the public reaction to nuclear missiles in the suburbs, the public reaction to the first Reagan Administration’s nuclear bellicosity, and then the miracle of Gorbachev. We have to be ready when there is an opportunity. We can still make small advances in the current situation, but we have to hope that there will be an opportunity again to make big advances.

The Plutonium Breeder Reactor

I was asked to mention some personal experiences. I will just talk about one that demonstrates that sometimes, even when the primary argument is economic and not technical, scientists can make a contribution.

Proposals were being made in the 1970s for what Glenn Seaborg, the discoverer of plutonium, described as a “plutonium economy.” In this vision, the world would be powered primarily by breeder reactors that would produce their own fuel, plutonium, from uranium-238. Figure 6 shows the projection made in 1974 of the future of nuclear power in the United States. The argument was that the U.S. could only build a thousand gigawatts of light-water reactor (LWR) capacity – roughly a thousand nuclear power reactors. After that U.S. high-grade uranium resources would be insufficient and we would need to use uranium more efficiently. We would need Liquid Metal Fast [plutonium] Breeder Reactors (LMFBR).

Where did this projection for the huge growth of US electricity consumption come from? Figure 7 shows how, for the previous half century, the US economy had become more and more electricity-intensive, with electricity use per dollar of gross national product increasing from about 0.07 in 1920 to about 0.4 kwh/$ in the mid-1970s. The nuclear-energy establishment was projecting that this trend would continue.
My colleague Robert H. Williams pointed out that, unless nuclear power was going to be very cheap, there was not going to be enough money to build all these nuclear power plants. I looked at what fraction of the economy had been going to electricity. As Figure 8 shows, it had been fairly constant – about 2.5±1 percent of the economy. When I looked at how this rough constancy of the amount of the economy going to electricity could be reconciled with the increase in electricity intensity, I learned that the price of electricity had been falling dramatically in constant dollars for 40 years (see Figure 9). We knew that nuclear power plants were very expensive, and in fact the utility investments in new nuclear power plants reversed the downward trend in electricity prices during the 1970s and early 1980s. In effect, the high cost of the first hundred nuclear power plants helped to end this very rapid growth of the electricity intensification of the economy.

Williams and I did this analysis as members of the Steering Committee of the Carter Administration’s 1977 LMFBR Program Review. President Carter was opposed to the plutonium economy because of its proliferation implications in any case, but our analysis may have helped convince him that the Atomic Energy Commission’s growth projections for nuclear power were vastly exaggerated and that he could oppose the development of breeder reactors. In fact, because of the slowing of the growth of U.S. electricity consumption and the high cost of nuclear power plants and then the accident at Three Mile Island Reactor number 2 in 1979, all orders for new nuclear power plants made after 1973 were cancelled. Only today, three decades later, is there talk again about building new nuclear power plants in the U.S..

The argument being made for liquid-metal fast-neutron reactors today in the U.S. is not that we need them to provide plutonium fuel, but that we need them to get rid of the plutonium in spent light-water reactor fuel. Now they are promoted as plutonium-burner reactors not plutonium-breeder reactors. […]

The Importance of Germany’s Independent Arms Control Scientists

The Volkswagen Foundation gave an important early impetus to Germany’s independent technically-based arms-control experts. In the US, foundations such as the MacArthur Foundation also are playing a very important role.

But arms control science is applied, not fundamental science. For example, when I talked with Princeton’s Physics Department about arms control physics, the response was “this is important but it has nothing to do with us.” Many Princeton physics professors have consulted with the Department of Defense on weapons issues but they don’t teach about the nuclear weapons issues in the university. So arms control science has never been fully accepted in the academic community and university arms control groups tend to have ad hoc institutionalization.

I, for example, have my appointment in Princeton’s School of Public and International Affairs, and the same is true of the handful of other academic arms control scientists in U.S. universities. In other countries, the academic community of arms control scientists is even smaller.

I remember the first time I visited the European Organization for Nuclear Research (CERN) in Geneva and saw what a huge institution it was. I said to myself, “The arms control physicists should have an institution like this.” But we don’t. As a result, our community is always on the edge of extinction. I worry that we might be wiped out by some fluctuation of support.
So I am very pleased that Germany has institutionalized in Hamburg University this year a new Centre for Science and Peace Research. The international nuclear arms-control community has also benefited greatly from the Interdisciplinary Working Group on Science Technology and Security (IANUS) at Darmstadt University of Technology. IANUS has produced so many excellent young arms control physicists. Martin Kalinowski heads the new Hamburg Centre. Annette Schaper is the arms control physicist at the Frankfurt Peace Research Institute. In the U.S., we have Alex Glaser in Princeton and Jürgen Scheffran is at the University of Illinois. IANUS has produced a large fraction of the young arms-control physicists in the world.

So the German community of arms control scientists represented by FONAS has become very important to the world of arms control science. The age profile of the German community is much better than that of the US community. It therefore is critical to the future of arms control science globally that Germany’s programs in this area continue and flourish.

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Frank von Hippel, a theoretical physicist, is Professor of Public and International Affairs and co-principal investigator of Princeton’s research program on Science and Global Security; fvhippel@princeton.edu.
Moved by Harald Mueller’s fine example, I will try to provide food for thought at the conference. I will not be able to achieve the level of coherence and insight that Harald has shown in his paper, but I do want to point out some differences in personal style as well as the substance of science advising. I refer to a 1992 paper distributed in preparation for this conference. In turn, it refers to several other papers or chapters, especially in books initiated by William T. Golden on science advice for the U.S. President and for the U.S. Congress.

In these earlier contributions I have discussed in some depth my personal experience, but only up to 1992. Since then, some of the previous controversies have been extended, if not resolved, and new questions have arisen. I make no excuse for the fact that most of my contributions have been in the technical field. I felt that there were substantially more people who could contribute in logical analysis and expertise in legal and policy matters, but that there were relatively few who had the experience and capability that I could bring to the table for the analysis of important technical issues. In addition to analysis, I have often managed to bring new technical approaches and opportunities to the discussion, as in the work of my President’s Science Advisory Committee’s Military Aircraft Panel and Naval Warfare Panel. The Naval Warfare Panel was fortunate to have Captain Elmo R. Zumwalt as its liaison with the Pentagon, and when Admiral Zumwalt was tapped to be the chief officer of the U.S. Navy (Chief of Naval Operations) following a brief tour of duty as head of the “brown water Navy” in Vietnam, he wrote me, “I am off and running on CAPTOR mines and cruise missiles.”

Sitting with the Panel two days each month for a year or more, and seeing things through our eyes as well as those of a U.S. Naval officer, Zumwalt was persuaded that these capabilities were important to the U.S. military. Indeed, his work on the modern cruise missile – first developed as the Tomahawk for submarine launch and then with the encouragement of Bill Perry, Director of Defense Research and Engineering at the time, evolved to the air-launched cruise missile – provided an inherently new capability to U.S. strategic forces.

Unfortunately, by that time the normal bureaucratic momentum had brought the B-1 strategic bomber program into being, which the air-launched cruise missile had made largely redundant. In the strategic area, when the Air Force wanted to replace the Minuteman III 3-warhead missile with the MX 10-warhead missile (mainly because it was the largest missile allowable under the 1972 SALT agreement), defense intellectuals cast it as a necessity because of the opening of a “window of vulnerability” for the silo-based Minuteman missile. Many unsatisfactory basing modes were posed for the MX, and Deputy Director Research and Engineering Bill Perry encouraged the JASON group of consultants to the government to work on an option that we had suggested – the basing of encapsulated MX missiles horizontally alongside small non-nuclear submarines.

I led that study, resulting in a secret report for the Department of Defense and then in an unclassified paper that Sidney D. Drell and I published in Technology Review. Several new concepts are in that paper, including the use of the Global Positioning System (GPS) to provide better accuracy for the MX missile launched from sea within a few hundred km of U.S. shores than for the silo-based MX. And provisions were made for achieving these accuracies, even in case of all-out nuclear war with the Soviet Union.

Other contributors in the same analytical/constructive style are Frank von Hippel with his group at Princeton University, and also Ted Postol, with his small group at Massachusetts Institute of Technology (MIT). We have sometimes worked together, as did Ted and I in 1999 in pushing boost-phase intercept of potential North Korean inter-continental ballistic missiles instead of the midcourse hit-to-kill intercept favored by the Missile Defense Agency, which is now undergoing continuous deployment and refinement at the annual cost of some US$ 10 billion. This despite our argument that a North Korean missile would carry effective countermeasures from the day it first appeared in service, with those simple countermeasures aluminum-coated spherical balloons – being made effective by antisimulation of the warhead itself. This means that instead of having replica decoys as does the United States for its Mark-5 reentry vehicle, in which
high technology is used to provide a quickly inflatable balloon that mimics the Mark-5 re-entry vehicle (RV) in every detail, antisimulation involves simply packaging the RV in an aluminum-coated spherical balloon that is collapsed around the RV until the RV is liberated in space and the command given to inflate the balloon.

Ted Postol and I and nine others joined to write a 200-page report on countermeasures. I believe that it is only in the last year or so that MDA has decided that they will at some time need to address the countermeasures. In my briefings and writings beginning in 1999, I argued that although there were possible counters to these countermeasures, in practice they would be considered seriously only when Missile Defense Agency had judged their system to be fatally impaired by the feasible countermeasures; and then actually to counter them there would need to be a diversion of substantial resources from the system as it is deployed.

Unfortunately, even if those proposing alternatives to or alterations in the committed program have a good practical grasp of what is required, it is very difficult to obtain agreement. After all, there is, by hypothesis, an “agreed program,” and once one reopens the question, there are many forces, both repulsive and attractive, that argue for various options. So it is difficult to get consensus on any one of them. Admiral Zumwalt himself felt that the massive aircraft carrier was obsolete in view of the potential of cruise missiles, but his alternative lost out because he did not stop the routine scheduled building of aircraft carriers in order to clear the way for alternatives.

In the year 2000 the National Reconnaissance Office had its 40th anniversary and I was named one of ten Founders of National Reconnaissance. Three of us are still alive – Bill Perry, Sidney Drell, and myself. In the mid-1960s, the President’s Science Advisory Committee’s Military Aircraft Panel that I led throughout the decade and longer argued that for the ground-attack role of aircraft, by far the greatest effectiveness would be achieved by “bombing by navigation.” That is, targets would be located in a global navigation grid, and munitions would be delivered to the desired point in a global navigation grid – that point occupied by the target to be destroyed. Moving targets could be handled by plotting and updating their trajectory in this global grid, extrapolating during the flight time of the bomb, for instance, by continued observation, taking into account that for the most part such moving targets are traveling on roads and so are constrained in two dimensions, with only the distance along the road varying with time. It was this concept as well as other utility that drove us to push very hard for the development and deployment of GPS. You might imagine my dismay when in 1980 the Chief of Staff of the Air Force reprogrammed the total GPS budget to other uses. In 1971, as an outgrowth of the Military Aircraft Panel, I led a Air Traffic Control Panel to study and advise on civilian air traffic control for the United States— both domestic and international. This opted strongly for an all-satellite system that would provide the three fundamental services of navigation, position monitoring, and communication to as many as 50,000 aircraft aloft at one time. This report was actually suppressed by the Federal Aviation Administration, the Science Advisor at that time being very weak, although our canny Executive Secretary of the Panel managed to arrange for the report, although unpublished, to be made available through the National Technical Information Service, where I believe it can still be ordered either on microfiche or in hard copy. We have in the past week scanned the document so that it is available as a PDF file (large because it is an image file) on my website.

Because when I joined IBM in December 1952, I had already had three summers of consulting with the U.S. government on matters of security and technology, I requested that IBM put into my employment contract that I would have 1/3 of my IBM time free to work with the U.S. government. IBM honored that commitment for the 40 years I was actively employed, and thus I was able to have great freedom in my activities with the U.S. government and never needed to look for contract support for the analyses and proposals that I was able to make from 1952 to 1993 and even to the present. The downside, however, was that I had only secretarial support at IBM – no group, no fellows or students working with me on these matters, although I did have people obtain their Ph.D. with me in physics. I see now that one has a better legacy and perhaps even a greater output if one makes the effort to have a group at a more conventional base such as a university or a national laboratory. Or perhaps not.

Another insight from reading Harald’s paper is a difference in personal style that I have noticed also in contrasting my mode of operation with those of others in the United States. I do not have a close personal relationship with any of the people whom I have advised. I did have dinner once at the home of Senator Ted Kennedy, but it came about by accident because I was on an air shuttle flight from New York to Washington that was delayed many hours in flight – so it must have been around 1968 – and my seat companion was Stephen Breyer, now a Supreme Court Justice. Through the long hours on board, we struck up a conversation and it turned out that we had a similar background in public policy. In fact, I had played a role in having the U.S. airlines required to avoid involuntary over-booking by offering compensation to those
who voluntarily gave up their seats on an airplane, and ultimately having an auction to make available as many seats as there were passengers who had been confirmed and who still wanted to fly. We found this interaction interesting, and he invited me on behalf of Senator Kennedy to join them at dinner that evening, where we found the others already largely finished with theirs.

I now provide a specific example – the one topic that was made public among those considered by the State Department’s Arms Control and Nonproliferation Advisory Board, that I chaired from 1994 to 2001. In order to provide an option to the public and broadly to the US Government that we had developed over several years in the advisory board sessions (two days per month) that had Arms Control and Disarmament Agency director John Holum as its audience, Holum authorized the presentation to a Committee of The National Academies on “Anti-personnel Land Mines Alternatives” of our approach to achieving the humanitarian goals of the Ottawa Convention, extending them to anti-vehicular landmines that are not controlled at all by Ottawa.

Perhaps it is because I have been involved in so many things and different groups that I’ve not been available, and also because my headquarters has been at the IBM laboratory, where I was isolated in this kind of activity, so one did not have political or executive branch personnel coming to talk to classes or to the policy-oriented groups that one finds at think tanks or universities. In addition to Ted Postol and Frank von Hippel, Sidney Drell who does more in the way of policy than he does these days in technical analysis, are highly effective in their personal relations with the people who count. In recent years, Dr. Drell has been a Fellow of the Hoover Institution at Stanford University, which has a steady stream of visitors and a staff that is connected to decision-makers. Drell has also taken the initiative to have important conferences at Hoover, one of which resulted in a recent Op-Ed in the Wall Street Journal.8

In summary, all I can say is that I hope that these historical facts and reflections have been worth your time. I think that what we do, in our different ways, is of critical importance, and it is my hope that the universities and institutes will be effective in strengthening such activities and the receptivity of those who are involved.

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"We practice total transparency»,  
Anne Lauvergeon, CEO, AREVA

"Transparency is a conjuror’s concept»,  
Daniel Pennac, French writer

The term “transparence” has been adopted by the French nuclear industry ever since Gorbachev’s glasnost had to be translated into French language, and since the devastating public perception of post-Chernobyl information management blew a hole in the nuclear consensus smoke screen. You must remember that officials stated at the time that French territory was exempt from radioactive fallout from the Soviet disaster. While on the German, Italian, and Swiss sides of the border vegetables and milk were destroyed, the French population was told that everything was safe to consume.

Since then, nothing much has changed in practice, except that the public relations budgets of the national nuclear companies skyrocketed and transparency became part of the desired image. When it comes to nuclear issues in France, the credibility of industry and government remains amongst the lowest in the European Union. When asked which sources of information they would trust on radioactive waste, 15% of French citizens polled trust the nuclear industry, 14% the government. Environmental organisations and independent scientists in France, scored 48% and 43% respectively – among the most trusted in Europe.1 But hardly anywhere – at least in the western part of the continent – is it more difficult to work outside the nuclear establishment. Even simple statistical information is withheld or its release delayed for months, making its use for a specific study or analysis task with any sort of deadline completely impossible.

Here is just the latest of countless examples that I have experienced over the last 20 years. On 26 March 2007, I call up the scientific advisor of the Special and Permanent Information Commission (CSPI) of the La Hague site to inquire about the status of the fulfilment of reprocessing contracts (by country, not even by client) and the status of the respective quantities of spent fuel still in storage. The CSPI is a committee that includes representatives from the operator AREVA, the government, local authorities, MPs, and environmental organisations. The CSPI advisor tells me that he does not have the information at hand but will ask for it.

On 15 June 07, almost three months and several e-mails after my initial inquiry, the advisor sends a written request (by e-mail and snail mail) to AREVA to update a 17-page public AREVA document from 2004 that I consider as the format of the required information. As of 5 September 07, no news, so I send another e-mail. The next day, the advisor replies by mail: “I have phoned the management this morning to find out when I would get a reply to my requests dated 5 April and 15 June (…). The secretary of the directorate shall call back; I’m awaiting the answer…”

By 6 December 07, over eight months after my first inquiry, I am starting to get somewhat annoyed and ask whether the absence of any response means that “the CSPI is now entirely incapable of obtaining and supplying simple information in a reasonable timeframe? Does it mean that it does not make any sense anymore to repeat requests over and over again, month after month?” On 12 December 07, I receive a message from the CSPI advisor:

“To my great surprise I have not received a response yet. (…) I have received excuses. (…) Now that we are at the end of 2007, it is better to wait for the beginning of the year 2008 in order to be able to add the results of 2007 to those requested of 2006 and 2005. Thus the request is relaunched and I apologize on my end for that difficulty to obtain a document. I’m in contact with the person that has committed himself and I’ll take care of it as soon as January [2008].”

On 4 April 2008, one year and nine days after my simple information request and following endless e-mail exchanges, the CSPI advisor gives the following amazing explanation:

“I have not received the promised dossier [from AREVA]. The reason I was given is the publication of the decree 2008-209 dated 3 March 2008 defining the foreign spent fuel and waste management procedures. (…) Article 8 responds to your request and to that of the CSPI: the inventory of stored French and foreign spent fuel and radioactive waste is subject of an annual report published before 30 June the following year.”

An article in a decree that “responds” to an information request? That is yet another innovative interpretation of “transparency.” In response to my protests, the advisor states: “I deplore this as much as you do and submit the...
problem to the CSPI Board in view of possible action.” To be continued. Possibly.

In June 2006, France has passed the law on Transparency and Security in the Nuclear Field, known as the TSN. According to the Nuclear Safety Authorities’ (ASN) Annual Report 2006:

“Access to documents and information in the field of civil nuclear energy is thus a reality and applies to the public authorities responsible for supervising it.”

A reality? The French Nuclear Safety Authorities have made progress over the last few years and grant public access, probably unique in Europe, to all inspection follow-up letters to operators. However, as the AREVA attitude documented here illustrates, the reality of operator attitude, so far, refers the following interpretation by the Safety Authorities to the world of wishful thinking:

“The TSN law considerably broadens access to nuclear-related information. It in fact establishes a statutory right of access by the public to information held by the licensees of nuclear installations and those in charge of radioactive material transports. While complying with specific arrangements (public safety industrial or commercial confidentiality, etc.), they are now required to transmit to whoever so requests the documents and information in their possession and related to their activities.”

Steven Aftergood, Director of the Project on Government Secrecy of the US Federation of American Scientists, has said that “information is the oxygen of democracy.” For an independent expert on nuclear issues in France the practice of “total transparency” remains a permanent threat of suffocation.

References
1 See Eurobarometer Special, 227; 63/2, June 2005.
2 I needed the data in particular for a report on reprocessing in France commissioned by the International Panel on Fissile Materials (IPFM); www.fissilematerials.org.

Mycle Schneider is an independent consultant on energy and nuclear policy based in Paris. He can be contacted at mycle@orange.fr.
The U.S. Military’s Influence on Nanotechnology Research in Latin America

GUILLERMO FOLADORI

Merchandise containing nanotechnology elements, like any other commodity, must be tested in the market to prove their superior utility and/or their competitive price against other conventional products. Consumption has an important role to play in order to evaluate the utility and the relative price of merchandise. Companies act in response to the market by improving the product in order to improve competition. But if at any time the goods cause undesirable secondary effects, they risk being taken out of the market causing damage to the supplying company.

Military merchandise is also evaluated by the users but, in contrast to civilian goods, military supplies are consumed during warfare. The utility of the product is measured according to its efficiency during combat, by deceiving defense systems of the enemy or in espionage missions, etc. Military technology, whether for combat or surveillance, can only be proven under fire in the theater of combat. Accordingly, the United States Army considers the main objectives for nano-electronic research and development to be: increase survivability through situational awareness, increase mobility through electronics, reduce operating and support costs, increase C4ISR\(^{1}\) and lethality, increase sustainability, and reduce the logistics footprint.\(^{2}\)

When the US launched its program to support nanotechnology development, it allocated a third of the overall budget for military research to this purpose – a level that has been maintained, between one third and one fourth.\(^{3}\) This policy encourages other countries to invest in nanotechnology for war.\(^{4}\)

Within Latin America, nanotechnology research is in its initial stages. The same applies for military nanotechnology research, although there are several agreements amongst countries to integrate this area into the agenda. However, it is important to note the increasing presence and sponsorship of the US armed forces in this field.

Scientific Neutrality Put Into Question

It is likely that most of the Latin-American scientists that participate in research projects or in meetings financed by U.S. military institutions do so thinking that their research is pure science\(^{5}\); nanoscience, and not nanotechnology; or, in other words, basic research containing no real application. This was a topic of heated debate and discussion, above all after the U.S. deployed nuclear bombs over Hiroshima and Nagasaki at the end of the Second World War. It is worth noting two important contemporary aspects: the first refers to the continuous decrease of the distance between time and practice of what are called the basic sciences and their practical use. The continuous entrenching of capitalist competition exerts pressure to decrease the cycles for capital rotation. Burrus & Gittines\(^{6}\) show how, in the last one and a half centuries, the distance between the discovering of a given invention and its introduction to the market has systematically been reduced. The result of this is the development of commercially driven science, mainly concerned with commercializing as fast as possible the new potential goods. In this context, nanotechnology is an eloquent current example. The U.S. Department of Defense (DoD) intends “(t)o accelerate the transition of materials from concept to service… should budget research-to-development transition funds and devise a method to select early the materials advances on which to concentrate funds. DoD should adopt measures to enhance communication between materials researchers and users.”

Moreover, the Mansfield Amendment of 1973 limited the scope of the defense related budget – through the U.S. (Defense) Advanced Research Projects Agency – exclusively to projects with direct military application.\(^{7}\) Consequently, the possibility for the DoD to finance pure science is legally banned unless it has a direct military application.

The second aspect that blurs the boundary between nanoscience and nanotechnology is the fact that there is a direct involvement of physics specialists, chemists and biologists in parallel to the participation of engineers, informatics technicians and others in the process of research and development (R&D) of knowledge. The U.S. initiative on nanotechnologies targets “converging technologies” at the interface between nanotechnology, biotechnology, informatics technologies, and cognitive sciences. A document from UNESCO related to the Ethical and Policy Aspects of Nanotechnology illustrates how the development of basic research requires the use of tools, practices, materials and techniques that are essentially technology, like computers, software, microscopes and the use of instruments to manipulate and to measure chemical and physical properties.\(^{8}\)

From the perspective of the scientists involved in the field there is a clear difference. Nanotechnology has, among other virtues, its tiny size and the fact that at this
scale materials present different properties. Thus this technology can be applied in any branch of the production process and/or services. Hence the inventions from the war industry can be redesigned for serving civil purposes and vice versa. This way, the war industry, by employing nanotechnology, can transform any civil invention into a military application. In 1999, the DoD handed over the responsibility of identifying key materials and the research and development of ways to incorporate them into the defense system to a special committee. This committee, the National Materials Advisory Board, released a publication in which it identified the most important areas for concentration: structural and multifunctional materials, energy and power materials, electronic and photonic materials, functional organic and hybrid materials, and bio-derived and bio-inspired materials. Due to the extensiveness of these areas of study, the committee established a separate panel to address each one. It now seems difficult to think that the military would not obtain any benefit from the civil innovations. What would be the difference, then, between research directly sponsored by the military or by a civil institution? The difference can only be answered according to mere ethical positions: either in favor of peace or in favor of an active military science and technology (S&T).

It is possible that many of the Latin American scientists who take part in research or reunions sponsored by the military system of the U.S. do not understand the real interests of the U.S. in its curiosity towards their most est investigations. In the end, their involvement with the scientific world is based on the relations they have with their counterparts in the U.S.; in addition, many of their fellow countrymen hold positions in U.S. universities; they speak the same language and have the same habits. Generally they speak about sensors, multifunctional materials, carbon nanotubes, and hybrid materials, topics that are difficult to relate to military applications. However, for the DoD the relationship is clear, there is nothing completely distinct from military interest, as the National Materials Advisory Board explained: “As the United States, its institutions, and its citizens interact throughout the world, situations may arise that call for military force. To safeguard its interests for the foreseeable future the United States must be able to project military power around the globe...”

Whereas other nations tend to operate from their own territory, as a matter of strategic principle the United States projects military power over long distances with medium-range and short-range systems.”

For this reason, the U.S. International Technology Center, which is one of the main organizations sponsoring nanotechnology research in Latin America and in the world, has as its mission: “To support the identification, acquisition, integration and delivery of foreign technology solutions to the warfighter to ensure technological superiority on the battlefield.”

Direct Presence of the U.S. Military in Latin American Nanotechnology Research

In certain research centers within Latin America, nanotechnology study has been conducted since the 1990s. However the most important stimulus came into being at the beginning of the 2000. The first official effort to encourage nanotechnology development took place in 2001 in Brazil, although the later Nanoscience and Nanotechnology Program implemented in 2004 is considered the most robust. In Argentina, the Argentinean Nanotechnology Foundation was created in 2005. In Mexico, without any official direction, approximately 500 researchers work in branches related to nanotechnologies in more of a dozen institutions or research centers. These three countries are those where nanotechnology R&D is most advanced.

The U.S. military interest in the development of S&T in Latin America is explicit; and even though much of the information related to the financing and human resources for this effort in Latin America is available online, direct contacts are always the basis for personal bonds which facilitate future collaborations. This is probably why, in April 2004, the U.S. Navy and Air Force hosted a forum in Washington, D.C., called the Latin America Science & Technology Forum. The explicit purpose for this forum was to increase the U.S. leadership’s awareness of the progress of S&T in Latin America. High representatives of civil institutions of S&T were present, from Argentina (vice-director of CONICET), from Chile (Director of FOND- EF-CONICYT) and from Mexico (Director for scientific research of CONACYT). They presented the state of S&T in their countries. This happened as if it were a responsibility for these civil institutions to inform the U.S. military about the general condition of the leading S&T that was taking place in Latin America. These personal contacts were complemented with official visits to Latin American countries. At the end of March 2002, the Associate Director of the International Area for Research of the U.S. Navy visited the University of Concepción in Chile, with the purpose of identifying research areas that could be incorporated into a special program on scientific cooperation.

The U.S. armed forces have at least three branches that finance scientific research (including nanotechnology) in public and private universities and in research centers world wide: the Army, the Navy and the Air Force. These three arms work together in S&T around the globe inside the International Technology Centers (ITC). To
be more effective there are several ITCs per geographical area. The ITC-Atlantic is headquartered in London and covers Europe, Africa, and parts of Asia, including former Soviet Union countries; the ITC-Pacific, headquartered in Tokyo, covers the rest of Asia and the Southern part of Africa; and in 2004, the ITC-Americas was created and is headquartered in Santiago de Chile to cover Central and South America and the Caribbean, including Canada. As with the other ITCs, the objective of the ITC-Americas headquartered in Santiago de Chile is "...to foster cooperative relationships between the U.S. Army and private sector, university, and civilian government research and development (R&D) entities that result in leading-edge scientific and technological cooperation that benefit the civilian institutions and support the U.S. Army’s current programs and future goals."  

Direct support for nanotechnology-related research in Latin America became reality. According to the U.S. Navy’s webpage, it has been financing a project at the Bariloche Atomic Center in Argentina in collaboration with the University of Michigan, Brown University, and the Naval Research Laboratory since 2004. In the same year a similar project was launched at the University of São Paulo in Brazil. In order to finance any given project, the U.S. army has to know the profile of the potential scientists who are willing to cooperate. For that reason, the U.S. Navy in partnership with the U.S. Air Force organized three international workshops in Latin America related to the main area of interest for the DoD, that is, multifunctional materials. The technological tools for creating these new materials are both micro- and nanotechnology; therefore, they are of the most interest to the U.S. Army and the U.S. Air Force regarding S&T in Latin America.

Accordingly, “The multifunctionality implies coupling between structural performance and other as-needed functionalities such as electrical, magnetic, optical, thermal, biological, and so forth. Structural integrity includes durability, survivability, reliability, and maintainability. This program thus focuses on developing and applying multifunctional mechanics principles and design methodology based on physics, chemistry, biology, and artificial intelligence to model and characterize the processing and performance of multifunctional material systems and devices at multiple scales.” Not Everybody Agrees

The U.S. military involvement in nanotechnology research in Latin America can not be reduced to merely the activities of military institutions in S&T. There are general agreements which stealthily support the possibility for future research in the area. The Mexican Government is one example. In 2005, Mexico signed, together with the U.S. and Canada, the Security and Prosperity Partnership of North America (SPPNA). This treaty includes, within its mandate, scientific collaborating schemes for R&D in areas such as biotechnology and nanotechnology, under a framework influenced directly by the military sectors.

There are several agreements signed between Mexican and U.S. institutions with an explicit participation of military laboratories, like the case of the Sandia Laboratories in New Mexico. The influence of the military over nanotechnology research not only comes from the relation between the civil sector and the U.S. military, but also from the Latin American armies who discuss the possibilities of using S&T for their own interests. On June 2006, in Buenos Aires, Argentina, representatives of several Latin American armies got together at the conference The Contribution of Science and Technology to Support Peace Keeping Operations and Disaster Relief Operation in Catastrophes. They came from Argentina, Bolivia, Brazil, Canada, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Mexico, Guatemala, Nicaragua, Paraguay, Peru, Uruguay, and Venezuela. The expected results went beyond the title of the conference, as it was recommended that for subsequent reunions certain topics should be discussed, such as the application of non-lethal technologies for crowd control; water purification and distribution; electric power generation and food preservation.

The debate that was unleashed after U.S. military involvement in some nanotechnology research in Argentina was made public shows the necessity to increase the transparency of information. In addition, it is important to build mechanisms to encourage public discussion about the implication of this technology for the region.

In October 2004, the Ministry of Economics of Argentina announced that the government was working towards a plan to develop nanotechnology within the country. It revealed that it had requested the ratification of an agreement with the U.S.-based company, Lucent Bell Technologies, to support the program. The agreement included the use by Argentinean scientists of laboratories located in New Jersey. Public reaction came quickly. The newspaper Pagina 12 published a set of articles depicting how some programs for scientific research in Argentina, and at least one in nanotechnology, were being financed.
by the U.S. Department of Defense. Immediately, the National Board of Ethics of Science and Technology issued a press release calling for the regulation of research, in particular any that is financed by foreign armed forces. At the same time, within the parliament, the S&T Committee of the Chamber of Representatives was requesting reports related to the scientific research financed by the U.S. Department of Defense.

Following the public controversy caused by this scandal in 2005, the seminar on multifunctional material organized in March 2006 by the U.S. Navy and the U.S. Air Force added more tension to an already delicate situation. Without delay, several newspaper articles made reference to this event. The Managing Director of the Atomic Center at Bariloche questioned the seminar, which was attended by one of his most important researchers.

The internal committee of the Union of Government Workers wrote a critical letter. Furthermore, the Chamber of Deputies of the Nation requested reports and more detailed information. The disputes reached the Executive of the Republic and thus the Manager Director of the Atomic Center at Bariloche quit his post.

Conclusions

It is natural to think that technological revolutions are intended for the general progress of human society. This is not entirely correct, because technological revolutions almost always bring benefits to some more than others. The idea that, over the long term, improvements to living conditions will reach everyone is still prevalent. The illusion about these future benefits were already the object of criticism by the environmentalists, they put the process of industrialization in the docket, illustrating that what could bring benefits in the short term could also bring evils in the long term.

We are on the cusp of a new technological revolution; according to some, it will be the most rapid and most profound of all to date: the revolution in nanotechnology. Although it is somewhat early to evaluate its possible benefits, if we pay attention to the orientation of such technology we can anticipate some important differences from the preceding technological revolutions that occurred throughout the history of humankind. The Neolithic Revolutions oriented itself to the improvement of food production. The Industrial Revolution, with a wider impact, guaranteed an important increase in first, the clothing industry, but later on in the production of daily supplies and on the means of production. The transportation revolution that took place at the end of the 19th century had a clear impact on the circulation of merchandise and people. But it is the peculiarity of nanotechnology development that it is being pursued with a very high attachment to military investments. U.S. public funds for nanotechnology research since 2000, when the National Nanotechnology Initiative was launched, fund between one third and one fourth of the budget of direct military investments. This, obviously, forces other countries to follow the same trajectory. This can contribute, perhaps, to the perpetuation of wars worldwide.

But to blame technology for human misfortunes is like giving life to it, which is illogical. The development of military technology is the result of the ongoing struggle to maintain economic hegemony and control over world politics, through direct violence. This is not a problem of technology; it is more the result of the imperialist character that some economies apply to S&T research. Scientists, many times, find themselves with the uncertainty that their research could or could not be directly financed by military institutions (often without their knowledge).

It is therefore important for the world and for Latin America to generate public debate about the orientation of S&T. The existence of ethical committees in charge of monitoring technology development and its financing become a necessity. The same applies to any research experimenting with human beings. Given the fact that in Latin America most of the research is still financed by public funds, it becomes paramount that S&T benefit the majority of the population. They should never be attached to military interests and/or commitments.

References
1 CAISR = command, control, communication, computer, intelligence, surveillance, and reconnaissance.
This is an abridged version of the Spanish version originally published in Rebelión (08/Nov/2006). I would like to thank Chistopher Coenen and Jürgen Altmann for their comments on this text, and Edgar Zayago for translating this essay from Spanish.
At this writing, the United States is six years into the “war on terror”, with an overstretched military mired in conflict in Afghanistan and Iraq, and no end in sight. Progress on preventing nuclear weapons use and keeping additional countries from developing or deploying nuclear weapons has slowed or reversed during the Bush Administration. To the extent that there is a budget debate within the US government right now, it is primarily about how much the US military budget should be increased. This is not an easy time to advocate disarmament, cooperative security, negotiation, and support for international institutions.

Even so, it is still important to make it clear that there are alternatives to the status quo. Serious consideration of alternative approaches to security and disarmament issues may indicate ways to increase both the feasibility and perceived desirability of disarmament. Should the political environment change, it will be useful to have performed this investigation. Conversely, if people are not presenting alternative policy approaches, the prospects for change diminish significantly.

In this context, a new non-governmental study holds promise of helping to inform the next Presidential administration; unfortunately, it is not likely to have much effect on the current administration. Nuclear Disorder or Cooperative Security: U.S. Weapons of Terror, the Global Proliferation Crisis, and Paths to Peace was sponsored by three expert analytic groups participating in security and disarmament policy: the Lawyers’ Committee on Nuclear Policy, the Western States Legal Foundation, and the Women’s International League of Peace and Freedom’s project, Reaching Critical Will. The book was written by seven top analysts in the non-governmental community. In effect, it is a non-governmental blue-ribbon panel. The authors are widely respected, thoughtful, and intelligent veterans of many international security battles.

The book is presented as a response to the “Blix Commission” report on weapons of mass destruction. But in fact it goes farther than the Blix Commission report, providing an integrated analysis of the opportunities represented by cooperative security and the risks of continuing along the present course. At the same time, it provides a thorough grounding in the international legal context for this work, with useful extensions of the analysis to issues such as nuclear power and climate change.

The Book’s Strengths and Weaknesses

Nuclear Disorder or Cooperative Security is a thoughtful, measured approach to a series of complex issues. Its structure and substance reflect the authors’ interest in multilateral approaches and negotiations.

Consistent with an inclusive definition of global security that includes human security, the authors concisely cover a wide variety of issues, ranging from nuclear power, the nuclear fuel cycle, and climate change to international legal structures and the US record of observance of international treaties. In just twenty pages, for example, the Executive Summary provides a thorough overview of the current state of non-proliferation and disarmament efforts. The six-page summary of recommendations at the end of the book is a handy quick reference.

Nuclear Disorder or Cooperative Security includes extensive quotes from the Blix Commission report to set the context for the discussion and recommendations. This makes it easy for the reader to grasp the core of the Blix report’s substance and recommendations. Importantly, the book’s authors do not merely accept the commission at face value. They point out weaknesses in the commission report in several places in the book, including highlighting the commission’s failure to propose rigorous standards for controlling missiles and other weapon delivery systems. The authors are arguably most critical of the commission’s use of the term “WMD” or weapons of mass destruction. Their compelling argument is that the term WMD conflates three extremely different types of weapons. The most important, nuclear weapons, are then blurred together with chemical and biological weapons. As the authors point out, one of the risks of such an approach is that people will believe that an attack with any of the three types can be responded to by any of the three types. In other words, a chemical weapons attack could provoke a response with nuclear weapons; an extremely dangerous scenario.

An unusual strength of the book is that it considers conventional weapons as well as nuclear. While conventional weapons often do not receive a great deal of attention, many books of this type would not even mention them. Some of the authors also devote attention to the challenges facing non-governmental organizations.
Republican Senators have successfully used parliamentary procedures to in effect require every important proposal to garner at least 60 votes, rather than the simple majority normally required for passage.

As pointed out in the chapter on the UN Security Council, that institution has the legal authority to deal with nuclear weapons and proliferation issues. Unfortunately, the failure of the United States, Russia, China, France, and the United Kingdom to live up to their commitments under the nuclear Non-Proliferation Treaty (NPT) severely undermines their credibility with respect to would-be nuclear powers.

Some of the authors also tend to underestimate the level of political change required in order to implement their recommendations. For example, one author writes that, “The most important means of revitalizing the NPT is good-faith implementation of the disarmament obligation. At some point, this will require an agreement or agreements that complete that obligation, integrate states outside the NPT, and institutionalize the elimination of nuclear weapons globally…” This implies a straightforward process, when in reality efforts at nuclear disarmament have been anything but straightforward. The author does not explain what changes in circumstances are likely to produce the agreements he advocates.

In addition, events outside the United States are not moving in the preferred directions outlined in the book. North Korea has declared that it has nuclear weapons, and although Iran claims it is not pursuing a nuclear weapons program, many outside observers are unconvinced. There are increasing questions about Syria’s intentions and the extent to which it may have received aid from North Korea. The Blix report warns of a potential “fourth wave” of proliferators.

With the continued proliferation of nuclear weapons and the failure of the first nuclear weapons states to meet their commitments under the Non-Proliferation Treaty, the entire regime is in danger. If North Korea deploys nuclear weapons, there may be pressure on South Korea, Japan, and Taiwan to follow suit. An Iranian nuclear weapons program might inspire Saudi Arabia and other countries in the Middle East to do the same. Convincing these countries to step back will require extensive global diplomacy, with economic and political carrots and sticks.

For those advocating disarmament, lack of “wallet” is also a significant factor. The authors highlighted the insufficient levels of foundation support currently available for groups and individuals working on these issues. Unfortunately, since the end of the Cold War, several major funders have left the field entirely. Others seem to have turned away from viewing philanthropy as a long-term investment in organizations and individuals. Instead, they are increasingly using short-term political tests as the

Barriers to Progress

Lack of political will is perhaps the largest barrier to implementing the book’s recommendations. In recent years it has been extremely difficult to gather the political capital necessary to implement the sorts of proposals included in this book. Even with the change in party control of the US Congress, progress has been virtually nonexistent. Republican Senators have successfully used parliamentary
determinants of progress. In this political environment, non-governmental organizations are virtually destined to fail such tests.

The Bottom Line

As the authors of Nuclear Disorder or Cooperative Security thoroughly document, the Bush administration has been implementing policies based on unilateralism and threats of preemption, undermining the non-proliferation regime and endangering US security. In so doing, the administration is helping to create the very threats to which it claims its policies are responding.

The development of new nuclear weapons by the United States is likely to be a self-fulfilling prophecy, as others rush to respond. In turn, pursuing new weapons also risks undermining the Comprehensive Test Ban Treaty. If the United States develops new nuclear weapons designs, there will then be a great deal of pressure to test them. At a Congressional hearing in April 2007, former Senator Sam Nunn argued against the Reliable Replacement Warhead, saying, “If Congress gives a green light to this program in our current world environment … I believe that this will be misunderstood by our allies, exploited by our adversaries, [and] complicate our work to prevent the spread and use of nuclear weapons.”

Continuing on the current course is likely to increase the risk of nuclear use, the potential collapse of the non-proliferation regime, and renewed nuclear arms races. Political change, especially in the United States, is critical if we are to make significant progress on the ambitious and useful agenda that these authors have constructed.

References

1 The Weapons of Mass Destruction Commission was established by the Government of Sweden in 2003. It is generally referred to as the Blix Commission, after its chair, Dr. Hans Blix. The full report of the commission, Weapons of Terror: Freeing the World of Nuclear, Biological and Chemical Arms, is available at www.wmdcommission.org. See also: Henrik Salander, Weapons of Terror, INESAP Information Bulletin #27, December 2006.

2 Unfortunately, the two chapters on gender (A Gender Perspective by Jennifer Nordstrom and Felicity Hill, p. 165) and on uses of language (The Word as Arrow by Peter Weiss, p. 161) are each less than five pages long, which is not enough space to do justice to these important topics.

3 Of the dozens of recommendations in the book, all but four focus primarily on the United States.

4 The Role of the UN Security Council written by John Burroughs, pp. 35-43.

5 John Burroughs, op.cit., p. 33.


DR. NATALIE J. GOLDRING is a Senior Fellow with the Center for Peace and Security Studies and an Adjunct Full Professor in the Security Studies Program, Edmund A. Walsh School of Foreign Service, Georgetown University; njg7@georgetown.edu.
While Germany can be seen as a key player in NATO nuclear policies, the German public, and even more so the youths, hardly know even basic facts about nuclear weapons. According to a survey sampled by Stratcom in 2006, only 12% of the German population know for sure that nuclear weapons are actually deployed in Germany. As nuclear weapons are a non-issue in most of the school curricula and materials, it is hardly surprising that young persons are often not even aware of basic facts about nuclear weapons, their current role in military doctrines, and the dangers.

To address this deficiency, INESAP together with IPPNW, Germany, the teachers trade union GEW, the office of the Lord Mayor of Hannover (who is a Vice President of the Mayors for Peace organization) and others developed the participatory educational project Nuclear Weapons Policy: Learn – Experience – Participate. By involving young people in the development of teaching and workshop materials and adopting an interdisciplinary approach, the project aims at making informative, easy-to-use, and appealing materials available in order to raise awareness in the wider public. The underlying premise is that knowledge can stimulate consciousness – and consciousness can stimulate action.

In cooperation with the European youth network BANg (Ban All Nukes generation), the first work result has now been published. The poster Nuclear Weapons in Europe provides an up-to-date introduction to the issue of nuclear weapons, with a particular reference to Europe. It can be used in classes or workshops for interactive work with youths aged 15 or older. The poster covers the topics Science – Technology; History – Politics; Culture – Psychology; and What does this have to do with me? The front page of the poster cites voices of young people from all over the world and contains a historic timeline. The world map on that page can be used, for instance, for an introductory quiz about nuclear weapon states and nuclear weapon free zones.

The poster is available in English and German, with the German version containing five additional sheets with more detailed information on the various topics that are covered by the poster.

Further educational material and a DVD are in the making. Support in terms of scientific consultancy, help to distribute the material, and assistance with fundraising is gratefully accepted.

References
2 IPPNW = International Physicians for the Prevention of Nuclear War.
3 Posters can be ordered at www.atomwaffenlernen.info/inhalt/bestellung.htm.
4 Just prior to publication of this article, the European Union declined a grant application for the project which might therefore have to be cancelled due to a lack of money.

Julia Kramer, Conflict Resolution M.A., is the project coordinator of “Nuclear Weapons Policy: Learn – Experience – Participate”; jkkramer@gmx.net. To see the poster, see www.atomwaffenlernen.info.
Beginning with his 1982 book, *The Fate of the Earth*, Jonathan Schell has written with power, clarity, and passion about the threat nuclear weapons pose to all humankind and the need to take bold action to avoid catastrophic failure. His latest book builds upon his earlier work and makes the case that today’s nuclear arsenals together with the growing spread of nuclear weapon know-how are creating a situation of extreme danger.

*Part I* of the new book presents a succinct history and analysis of the misguided thinking about the utility of nuclear weapons and nuclear policies since 1945. *Part II* is devoted to Bush Administration’s 180-degree reversal of traditional U.S. non-proliferation policy by seeking to prevent and reverse nuclear proliferation by use force instead of diplomacy and treaties. The subtitle of this part is aptly chosen: *Rise and Fall of the Bush Doctrine*.

*Part III* of the book is devoted to what Schell refers to as the Second Nuclear Era, the period beginning with the end of the Cold War. His focus is the current scene in which it has become recognized that non-state terrorists might acquire a nuclear weapon and yet the nuclear weapon states are focusing on “improvements” to their arsenals. Schell sees the abolition of nuclear weapons by global agreement as the only way out of the growing threat nuclear weapons pose to humankind. Schell is no stranger to the many obstacles that must be overcome to achieve nuclear abolition given that two of his earlier books, *Abolition* (1984) and *The Gift of Time* (1998), have abolition as their main themes.

Fortunately, Schell’s latest call for global nuclear abolition comes at a time it is likely to receive the serious attention it deserves. It connects directly to the George Schultz, William Perry, Henry Kissinger and Sam Nunn OpEd in the January 4, 2007, Wall Street Journal arguing that the global abolition of nuclear weapons must become the ultimate goal of nuclear arms control. That surprising OpEd is the product of an October 2006 conference the Stanford Hoover Institute celebrating the 20th anniversary of the Reykjavik Summit at which Presidents Reagan and Gorbachev agreed abolition should become the goal for nuclear arms. The January 2007 OpEd has gained the support of many high-level military and civilian figures from past U.S. administrations, and the leadership of the U.K. has signaled its support as well.

The outcomes of the U.S. Presidential and Congressional elections in November 2008 will have a major impact on U.S. nuclear posture. Without dedicated U.S. leadership, global nuclear abolition will go nowhere.

**Jeremiah Sullivan**

*The Seventh Decade*  

The International Network of Engineers and Scientists for Global Responsibility (INES) published the following Newsletters in recent months:

**Special Edition for the NPT PrepCom 2008**
- The Non-proliferation Treaty and Human Survival by Dr. David Krieger
- Words to the NPT PrepCom Geneva 2008 by Judge Christopher Weeramantry
- Military R&D 85 Times Larger Than Renewable Energy R&D by Dr. Stuart Parkinson
- UN Voting on Nuclear Disarmament Shows Abysmal US Record by Dr. David Krieger

**No 58, March 2008**
- Nuclear weapons and their link to nuclear energy. How to deal with the dangerous connection? by Wolfgang Liebert
- Activities and Achievements of the rural Development & Youth Training Institute in Rajasthan, India by Jambu Kumar Jain
- 1st Indian National INES Conference: Role of Scientists & Engineers Towards Social Responsibility in Developing Countries, 9 December 2007, Nagpur, India
- Science, Peace and Sustainability: Mexico INES Conference Review by Alberto Salazar
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Global Conscience

BY DOUGLAS ROCHE

Already the 21st century looks like a repeat of the 20th: every day brings more news of war, poverty, human rights violations and destruction of the environment. Discouraging to be sure. But underneath the surface, something is happening to lift up humanity.

An awakening of concern about how we human beings treat one another on the planet is taking place. This has tremendous possibilities for moving the world forward to a new era of peace. In fact, this new awareness of a global conscience is the great untold story of our time ... A new caring for the wholeness of life is being defined.

Humanity is learning to understand all our human relationships, our relationship with the Earth, and how to govern for the common good.

This is the stirring of a global conscience.

Global Conscience contains 30 international case studies, illustrating the interplay of public policy and private actions that will guide an enlightened path to human security.

Douglas Roche explores the emerging global conscience, the maturation of civilization, that has become the story of our time. Beyond the widely publicized news of war, poverty, and human rights violations is the uplifting awakening of concern for our fellow human beings as nations are calling for a new global ethic to make the world a better place.

By looking at what we have achieved, we are able to provide hope and empowerment. A "Yes, I can make a difference" mentality allows us to break free of the immobilizing fear, affirming that the route to public policies built on global conscience is possible.

Journalist, politician, academic, and diplomat, Senator Douglas Roche is one of Canada's foremost experts on peace and disarmament. He is currently Chair of the Middle Powers Initiative, a member of the Pugwash Council, the former Canadian Ambassador for Disarmament, and former Chairman of the United Nations Disarmament Committee. His previous Novalis book, The Human Right to Peace, was released in 2003.

About INESAP

INESAP is the International Network of Engineers and Scientists Against Proliferation and was founded in 1993. It is a non-profit, non-governmental network organization with participants from all over the world.

INESAP is part of the activities of the International Network of Engineers and Scientists for Global Responsibility (INES), which currently comprises more than 60 organizations from 25 countries. INES is a UN accredited NGO.

Although those active in the network can and do work independently with each other, the office plays an essential organizational role in most INESAP activities. It is hosted by the Interdisciplinary Research Group in Science Technology and Security (IANUS) at Darmstadt University of Technology. The INESAP Coordinator (Regina Hagen) cooperates closely with the international Coordinating Committee.

If you want to support the work of INESAP, you can send cash money, use our PayPal button (preferred to avoid high bank charges) or a cheque to the INESAP office or transfer money as follows:

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INESAP Coordinating Committee
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Editorial Board
Alexander Glaser, Regina Hagen,
Andrew Lichterman, Götz Neuneck,
Jürgen Scheffran, Dave Webb

Coordinating Editors
Dr. Jürgen Scheffran, Regina Hagen
INESAP, c/o IANUS
Technische Universität Darmstadt,
Hochschulstr. 4a, 64289 Darmstadt,
Germany
Phone +49-6151-16 44 68
Fax +49-6151-16 60 39
inesap@hrzpub.tu-darmstadt.de
www.inesap.org

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A panel discussion on Friday, May 2, 10 – 12 am
Geneva, Palais des Nations, Room XXV, Building E
Panelists: Zia Mian, Research Scientist, Princeton University’s Program on Science and Global Security, Princeton/USA
M.V. Ramana, Senior Fellow, Centre for Interdisciplinary Studies in Environment and Development, Bangalore/India
moderated by Regina Hagen, Coordinator, INESAP
sponsored by the Abolition 2000 US-India Deal Working Group

SIMULATED NEGOTIATIONS FOR A NUCLEAR WEAPONS CONVENTION
May 3, 10 am – 6 pm
Participants: more than 50 youths and university students
A Simulation Game for negotiations on a Nuclear Weapons Convention for young people. Similar to a Model UN, the young people will negotiate Articles I (General Obligations) and IV (Phases for Implementation) of the Model Nuclear Weapons Convention.
Chaired by Ambassador Alfredo Labbé of Chile
Sponsored by Ban All Nukes generation (BANg), INESAP, Technische Universität Darmstadt, and others.
Come and observe the negotiations!

ENVIRONMENTAL ASPECTS OF NUCLEAR ENERGY
A panel discussion on Tuesday, May 6, 3:30 – 5:30 pm
Geneva, Palais des Nations, Room XXV, Building E
Panelists: Manuel Meyer, University of Hamburg, Hamburg/Germany
Philipp Wessels, University of Hamburg, Hamburg/Germany
Merav Datan, Greenpeace International, Tel Aviv/Israel (tentative)
Sharon Dolev, Greenpeace International, Tel Aviv/Israel
moderated by Regina Hagen, Coordinator, INESAP
Sponsored by INESAP and the University of Hamburg

IN ADDITION, PLEASE TAKE NOTE OF THE FOLLOWING EVENTS (CO-)SPONSORED BY INES, THE INTERNATIONAL NETWORK OF ENGINEERS AND SCIENTISTS FOR GLOBAL RESPONSIBILITY:

WHY SHOULD NUCLEAR WEAPONS BE ABOLISHED?
A Roundtable on Tuesday, April 29, 6:30 pm
International Red Cross and Red Crescent Museum Auditorium, 17 Avenue de la Paix
Speakers: Ambassador Jürg Streuli of Switzerland
John Burroughs, International Association of Lawyers Against Nuclear Arms (IALANA), New York/USA
Reiner Braun, International Network of Engineers and Scientists for Global Responsibility (INES), Berlin/Germany
Chairperson: Daniel Warner, Graduate Institute of International and Development Studies (GIIDS), Geneva/Switzerland
The event will start off with a short presentation by the President of the City Council of Florence, Eros Crucellini, on “1954 at the Red Cross: Mayor of Florence declares ‘Cities Are Not Targets!’ ”
Sponsored by REAL Exhibition Development, IALANA, INES, and the Mayors for Peace.

MILITARY RESEARCH
A workshop on Monday, May 5, 10:15 – 12 am
Geneva, Palais des Nations, Room XXV, Building E
Speaker: Stuart Parkinson, Scientists for Global Responsibility (SGR), Folkstone/UK

SPECIAL ANNOUNCEMENT:

IN-SECURITY, THE NUCLEAR DILEMMA
A temporary exhibition from 27 February to 27 July 2008
International Red Cross and Red Crescent Museum Auditorium, 17 Avenue de la Paix
open from 10 to 17, except Tuesday – admission free
An exhibition produced by Ashley Woods, REAL Exhibition Development, and the International Red Cross and Red Crescent Museum, with the support of the International Peace Bureau and Joseph Rowntree Charitable Trust.
For more details, see www.micr.ch/e/exhib/explore_current_e.html.

SIDE EVENTS AT NPT PREPCOM 2008
You are invited to the following side events at the Non-Proliferation Treaty Preparatory Committee meeting in Geneva of 2008.

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